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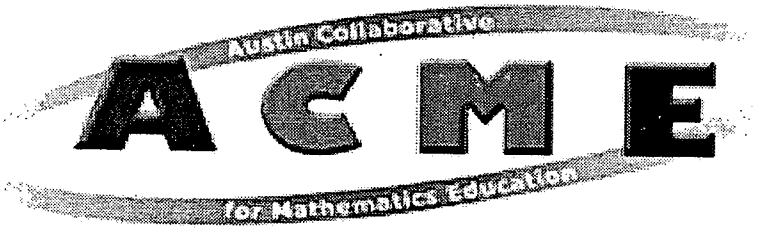
ABSTRACT

In 1997 the Austin Independent School District (AISD) (Texas) launched the Austin Collaborative for Mathematics Education (ACME), a project funded by the National Science Foundation to improve mathematics education districtwide. The initiative provides all K-8 mathematics teachers in the district with long-term professional development and campus-based support to implement current national standards for mathematics curriculum and instruction. The teaching practices of teachers before and after participation in ACME programs were examined. A random sample of 248 mathematics teachers and 39 special education teachers returned completed questionnaires on attitudes toward mathematics reform, teaching practices, content knowledge, and demographic characteristics. Ten randomly selected classrooms and 3 special education classes were observed. During the ACME project's first year, teacher attitudes changed from anxiety to confidence and interest in mathematics reform. The investigative culture and design of ACME professional development were rated "effective" by teachers. Strong points included the professional community of learners ACME supported, and the responsiveness of the program to teacher concerns. Some challenges to the program were identified, and recommendations are made for program improvement. Appendixes contain the teacher questionnaire and study interview protocols. (Contains 1 figure, 5 tables, and 13 references.) (SLD)

AUSTIN COLLABORATIVE FOR MATHEMATICS EDUCATION

1997-1998 Annual Report



Austin Independent School District
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EXECUTIVE SUMMARY: AUSTIN COLLABORATIVE FOR MATHEMATICS EDUCATION, 1997-98 ANNUAL REPORT

Author: Michelle L. Batchelder, Ph.D.

Overview

In the summer of 1997, the Austin I.S.D. launched the *Austin Collaborative for Mathematics Education* (ACME), a project funded by the National Science Foundation (NSF) to improve mathematics education districtwide. The initiative provides all K-8 mathematics teachers in the district with long-term professional development and campus-based support to implement current national standards for mathematics curriculum and instruction. Through the ACME professional development, district administrators intend to build a community of learners and to help teachers explore and acquire mathematics content, the philosophy of standards-based pedagogy, and classroom management for investigative mathematics instruction. In 5 years, over 2000 teachers, including general and special education, bilingual education, and English as a Second Language (ESL) teachers, will participate in the ACME project.

The purpose of this evaluation is to examine the teaching practices of educators before they participate in the ACME professional development and to describe district teachers' and principals' attitudes toward mathematics reforms, the quality of ACME professional development, and the supports in the district and community to implement the project in its first year.

Methodology

Of a random sample of K-8 teachers, 248 mathematics and 39 special education teachers returned completed questionnaires on attitudes toward mathematics reforms, teaching practices, district support, mathematics content knowledge, and demographic characteristics. All 82 principals of the district's elementary and middle schools completed questionnaires about school reforms, attitudes towards standards-based mathematics and science education, support for the ACME project, and school demographics. Ten randomly selected mathematics classrooms and 3 special education classrooms were observed and rated for the effectiveness of the instruction. Eight professional development sessions were observed and rated for quality and effectiveness. In addition, district and ACME project staff were interviewed about their experiences with the project and opinions about its progress.

Major Findings

Strengths of ACME

- Most teachers new to ACME and principals were familiar with the language of standards-based mathematics and highly endorsed its practices.
- During the ACME project's first year, the attitudes of teachers who participated in ACME professional development transformed from anxiety and apprehension to confidence and interest.
- The investigative culture and design of ACME professional development were primarily rated effective for supporting teachers' efforts to enhance children's mathematical competence.
- Strong points include the professional community of learners that the ACME project has established, the collaboration it encouraged within and across campuses, and its responsiveness to teachers' concerns.
- Additional strong points include the alignment of district policies and curriculum as well as financial and material backing for the project.

Challenges of ACME

- Determine where deep understanding of standards-based mathematics education is lacking in the face of familiarity with the language of current standards for mathematics education in the district; teachers' descriptions of their teaching practices and observer ratings may differ.
- Raise the quality of implementation, mathematics content, and pedagogy in ACME professional development, especially as the project adds teacher leaders who have little experience as facilitators.
- Maintain full teacher involvement over the course of ACME professional development and garner the full involvement and leadership of school administrators.
- School administrators and teachers need to agree on time for teachers to collaborate about mathematics education as well as promote more parent involvement in mathematics education.
- A particular challenge to ACME is the high stakes state and district assessment system.
- Establish support structures that will sustain high quality professional development in the district after ACME is complete.

Recommendations

- Foster among the district's teachers, principals, central office administrators, and the community an understanding of the difference between superficial implementation and standards-based instruction that enhances children's mathematical competence by building bridges between experienced and inexperienced educators.
- Continue to address teachers' concerns about implementation through the framework of the Concerns-Based Adoption Model.
- Continue to provide teachers and principals with ongoing high quality professional development and to promote the professional community of learners that is emerging.
- Campaign for full participation of teachers and administrators in ACME professional development.
- Teachers need to make use of time set aside for collaboration on mathematics education and share innovative strategies that promote collaboration across campuses.
- Continue to address concerns about the relationship between standards-based mathematics curriculum and instruction and the district and state assessment system.
- Share lessons learned from the evolution of the ACME professional development system with the district's department of professional development and develop a powerful, self-sustaining program.

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OVERVIEW OF THE PROJECT

In August of 1997, the Austin Independent School District (AISD) launched a Local Systemic Change initiative to implement national standards for mathematics curriculum and instruction in all K-8 classrooms. This district initiative, the *Austin Collaboration for Mathematics Education* (ACME), is funded in part by the National Science Foundation (NSF), and is a partnership with the Charles A. Dana Center and the University of Texas at Austin. ACME is a unique approach in that it provides systematic and continuing professional development for every elementary and middle school mathematics teachers in a large urban district.

Through ACME, each K-8 mathematics teacher in the district participates in a minimum of 120 hours of formal professional development including summer institutes, follow-up training during the academic year, and campus level support such as peer coaching, collegial sharing, and modeling. The intent of professional development is (1) to build sound practice in mathematics instruction, (2) to ensure consistent implementation of a quality mathematics curriculum, and (3) to provide ongoing support for teachers and administrators to implement standards-based curriculum and instruction in every classroom in the district.

The initiative takes place in a growing urban district with over 75,000 students, approximately 55,000 of whom are of elementary and middle school age. The project currently works directly with 68 elementary schools and 15 middle schools. The size of schools is diverse, ranging from 500 to 1700 students for middle schools and 275 to 1300 students for elementary schools. The district serves a racially and ethnically diverse student population. Forty-three percent of the students are Hispanic, 37% are Anglo, 18% are African American, 2% are Asian or Pacific Islander and less than 1% are Native American. Among the students, 14% have limited English proficiency and 50% qualify for free or reduced lunches through federal funds.

The major goal of the project is to raise the mathematics achievement of all students in the district by implementing a rigorous, standards-based curriculum for every child. The Texas State Accountability System has revealed inequities in students' mathematics achievement through their performance on the Texas Assessment of Academic Skills (TAAS). Although in recent years the percentage of students who pass the mathematics segment of the TAAS test has increased, students who are African American, Hispanic, or economically disadvantaged consistently perform below the average for all students (Williams, 1998). District administrators recognize the need to provide students with the mathematics understanding, reasoning, and communication skills that move beyond mathematics computation.

To address these needs, the initiative assists elementary and middle school staff in implementing the district curriculum that is based on standards designated by the National Council of Teachers of Mathematics (NCTM, 1989, 1991, 1995.) District staff are purchasing the curriculum resources of *Investigations in Number, Data, and Space* for elementary grades and *Connected Mathematics* for middle grades to support teachers' implementation of standards-based instruction. These curriculum resources are particularly well suited for AISD because they support the following teaching practices (cf. Russell, 1998):

- Promoting children's mathematical thinking, reasoning, and problem-solving skills;
- Developing children's deep understanding of mathematical concepts through hands-on experiences, real-world problems, and communication; and
- Supporting a vertically and horizontally coordinated curriculum that considers the needs of all students, including those who are special education, gifted and talented, limited English proficient, and bilingual.

These investigative practices emphasize mathematical literacy through the understanding of mathematics concepts and approach instruction through problem-solving and communication of mathematical ideas. These practices contrast with traditional practices that emphasize mathematical algorithms, rote memorization, and mastery of computation (Cohen & Ball, 1990).

To support improvement in students' mathematical competence in every classroom, district administrators also recognize the need to build a community of learners that fosters teachers' professional growth as mathematics instructors. The ACME project provides long-term professional development designed to facilitate teachers' exploration and acquisition of mathematics content, the philosophy behind standards-based pedagogy, and classroom management for investigative, inquiry-based mathematics instruction.

Through the ACME project, each of the district's K-8 mathematics teacher, participates in a series of professional development activities over three years. The more than 2000 participants include general education, special education, bilingual, and English as a Second Language (ESL) teachers. The first two years include week-long summer institutes and five follow-up days during each academic year. The third year involves less formal professional development to continue through campus initiatives that the project will support. Teachers are paid a stipend to attend the summer institutes and follow-up sessions outside school hours, and substitutes are provided to release teachers during the academic year.

The implementation plan begins at the transition between elementary and middle school. Thus, in the summer of 1997, staff development began with fifth and sixth grade teachers, followed by fourth and seventh grade teachers in the summer of 1998, and will continue with kindergarten through third grade and eighth grade teachers in subsequent years. In addition to grade-by-grade implementation, eight elementary schools and three middle schools are serving as pilot sites with all grade levels participating in the initiative simultaneously beginning in year one of the project.

A second goal of the initiative is to establish systemic change by developing school cultures in which communities continually improve mathematics teaching and learning. In the summer of 1998, ACME provided an institute for principals and their assistants that addressed administrative issues such as strategies for supporting teachers in implementation of standards based curriculum and instruction. The project also makes use of organizational structures already present (e.g., curriculum specialists) to support teachers on campuses. Through these campus leaders, the project disseminates information to teachers on every campus. The ACME project staff is also developing customized professional development for lead teachers so that they may facilitate professional development sessions and support their peers on the campus level in a variety of ways, including peer coaching, demonstration teaching, information sources, and

sharing classroom management techniques. To garner parent participation in the mathematics curriculum, the project staff provides schools with technical support (e.g., pamphlets and videos in English and Spanish) as well as assistance with organizing parent education and involvement (e.g., parent math nights).

Additionally, the project staff enlists support from the district's administrative leaders. Central and campus administrators have undergone numerous changes over the past five years, including the resignation of the superintendent and appointment of an interim superintendent in April of 1998. Throughout these changes, support for the ACME project has continued.

A third and final goal of the project is to ensure that all of the district's resources and efforts in mathematics education are aligned with local, state, and national standards. ACME project staff assert that the district's mathematics curriculum document, the state standards in the Texas Essential Knowledge and Skills (TEKS), and the NCTM (1989, 1991, 1995) standards are aligned. To ensure that these standards emerge in the district's mathematics classrooms, the ACME project channels local, state, and federal funds to teachers' professional development and to support the district's textbook adoption of the curriculum resources.

METHODOLOGY

PURPOSE OF EVALUATION

NSF requires an evaluation of ACME in collaboration with Horizon Research, Inc. (HRI), an educational research group contracted to design the national evaluation of mathematics and science systemic change initiatives. This evaluation is formative, and provides information about project implementation so that decision makers can make improvements. The purpose of this report is to establish a baseline for what mathematics education and instruction looks like in the district and the current supports for implementation. The report presents attitudes of teachers and principals toward mathematics reforms, documents mathematics classroom instruction, examines the quality of teachers' professional development, and assesses the extent of support for the project districtwide.

SAMPLE AND PROCEDURES

To establish a clear picture of mathematics education and instruction throughout the district in the ACME project's baseline year, data were gathered from multiple sources and in various formats that are described next.

Teacher Questionnaires

The local evaluator prepared a list of all elementary and middle school mathematics teachers who were employed by the district as of February of 1998. A previous survey revealed that some of the district's elementary schools departmentalize grade levels such that some educators teach language arts and/or social studies but not mathematics (Batchelder, 1998). Therefore, the evaluator phoned campus administrators to screen the list for mathematics teachers only. From this list, HRI selected a random sample of 300 mathematics teachers, and the evaluator mailed questionnaires to these teachers. These questionnaires, designed by HRI, survey teachers' attitudes toward national standards for mathematics instruction, preparation to implement the standards, classroom practice, mathematics content knowledge, perceptions of district support, demographic characteristics, and experiences in ACME professional development. (See Appendices for a sample teacher questionnaire.)

A few weeks after the first mailing of questionnaires in April of 1998, 50% of the teachers had returned the forms. A second mailing was sent out in May to teachers who had not yet returned a completed questionnaire. Additionally, teachers who had returned the questionnaire but skipped some items were sent photocopies of the pages with missing information and a request to return the completed copies. At the beginning of May, principals were given a list of teachers at their school who had not yet returned the forms and were told to ensure that the forms were returned. Out of the original 300 mathematics teachers in the sample, 11 were omitted for various reasons such as not teaching mathematics, parenting or maternity leave, resignation, and retirement. A total of 248 mathematics teachers out of the 289 valid respondents returned completed questionnaires yielding a response rate of 86%.

In addition to these mathematics teachers, a sample of 50 special education teachers was sent questionnaires. Four teachers were omitted because they did not teach mathematics, had resigned, or were not presently teaching special education. Thirty-nine special education teachers out of the 46 valid respondents returned questionnaires with a response rate of 85%.

Additional sources of information from teachers included informal interviews and observations during professional development. The ACME project staff also designed questionnaires for teachers to evaluate the professional development. Teachers' responses to these evaluations provided information about enhancement of their knowledge of mathematics content, strengths of the sessions, concerns about implementing the standards-based curriculum and instruction, and suggestions for improving the project.

Principal Questionnaires

In April of 1998, a survey was sent to the principals of all of the 15 middle schools and the 66 elementary schools, as well as to the principal of the Alternative Learning Center. The principal questionnaires assessed the extent of school reforms, attitudes toward standards-based curricula in mathematics and science, district and state support for the ACME project, familiarity with the project, and school demographics. (See Appendices for a sample principal questionnaire.) Data collection procedures for the principals who did not complete their questionnaires paralleled those used for teachers. In mid-May, the evaluator called principals who had not yet returned their forms. All 82 principals returned the questionnaires for a 100% response rate.

Classroom Observations

From the sample of 300 elementary and middle school mathematics teachers, HRI randomly selected 10 teachers, none of whom had participated in ACME professional development, for classroom observation. One back-up teacher was observed because one teacher in the original sample had been pulled from the classroom to teach a literacy project full-time. All of the observed classrooms were kindergarten through fourth grade classes, except one, which was a seventh grade class. The lead evaluator also drew a random sample of four special education teachers to observe. One of these teachers was on leave and another declined to be observed because she was going on maternity leave. A back-up special education teacher was randomly selected so that a total of three special education classrooms could be observed. For all of the observations except two in which there were scheduling conflicts, an entire mathematics lesson was observed.

In March of 1998, the lead evaluator and ACME project manager were both trained and certified to rate classroom observations reliably using HRI's classroom observation protocol (HRI, 1998; see Appendices for a sample protocol and pre- and post-classroom observation interviews). The lead evaluator rated all of the classroom observations except one, which the project manager rated. The protocol is used to rate a classroom observation on an ordinal scale, which consists of five global categories that are qualitatively different and describe the extent to which a teacher's mathematics instruction is effective and meets national standards.

The purpose of the classroom observations in the baseline year is to capture a snapshot of mathematics instruction in the district before teachers participate in ACME professional development. It is important to note that the small sample of 10 observations

is not representative of all mathematics instruction in the district; the frequencies and proportions of the categories do not generalize to the district as a whole. Rather, these observations generally depict some of the different types of instruction in the district as the project launches, not the relative frequency of the types.

Professional Development Observations

The lead evaluator observed 16 professional development sessions to assess quality and content and formally rated 8 of the sessions with HRI's professional development observation protocol. (See Appendices for a sample protocol.) This protocol is similar to the one for classroom observation protocol in that it results in global ratings on a 5-point ordinal scale ranging from *ineffective* to *exemplary* facilitation but for adult learners. The eight sessions observed represented three different formats of the project's professional development. One session was for school administrators and provided logistical and conceptual information about the new mathematics curriculum and instruction, suggestions for answering parent concerns, support for teachers, and so on. Another session was a follow-up during the academic year for fifth and sixth grade teachers to compare their materials. The other six sessions observed were week-long summer institutes that covered pedagogical and mathematics content for fourth grade teachers in their first year of the ACME project and fifth grade teachers, most of whom were in their second year. The evaluator conducted these additional sessions to meet the project director's request for a complete assessment of professional development provided by all of the facilitators. For the remaining sessions, the evaluator was a participant observer. Two of these observations included the summer institutes for sixth and seventh grade teachers for which the project hired facilitators from Michigan who have extensive experience as trainers and have test-piloted *CMP* in their classrooms. Observations that were rated lasted from one hour to one-half of a day, and informal observations lasted from one hour to one-half of a day or longer.

Interviews with District and Project Staff

This evaluation also included information about project procedures and its history as well as district policy gleaned from semi-structured interviews with district administrators and project staff. These sources include the deputy superintendent of instructional services and school operations, the mathematics supervisor and ACME project director, the project manager, and a mathematics specialist who facilitates professional development for all district employees. A project director of the State Systemic Initiative (SSI) at the Dana Center reported on the project's history and design. This person has been instrumental in planning the project and participated in an early mathematics reform effort in the district as an area superintendent. In addition, the lead evaluator participated in the ACME project meetings, in a retreat at which the facilitators reflected on the first year of implementation, and in informal conversations with project staff. These interviews and observations provided different perspectives of the project's functioning in the baseline year.

Additional sources of data for this report include the district's grant proposal to NSF and subsequent revisions, the district and state mathematics curriculum documents, professional development materials, and brochures for parents.

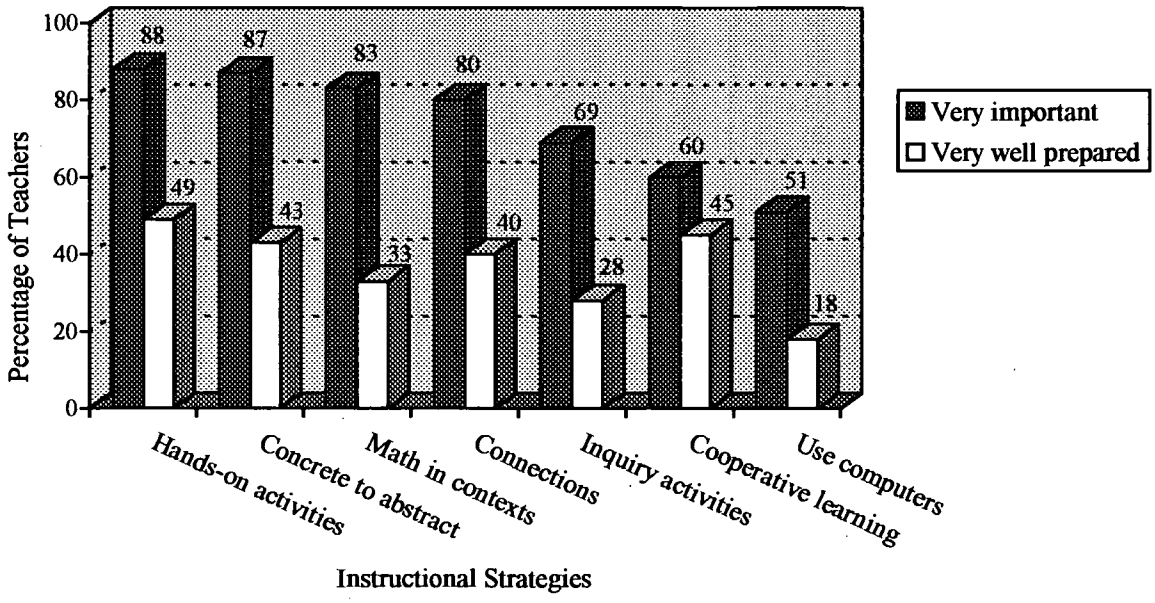
RESULTS AND DISCUSSION

The findings presented in this section integrate different perspectives on the ACME project, including the viewpoints of teachers, principals, and central office staff. This section includes data on the district's mathematics curriculum and instruction in the ACME project's baseline year, the quality of professional development provided, and the supports for sustaining the project.

In general, the data from teacher questionnaires were taken from the responses of the 289 mathematics teachers because in many cases their responses were not different from those of the 39 special education teachers who completed questionnaires. Where the differences in the responses of these two teacher samples were statistically significant, the discrepancies were noted.

TEACHERS' ATTITUDES TOWARD AND PREPARATION FOR MATHEMATICS REFORMS

Figure 1. A Comparison of the Percentage of Teachers Who Responded *Very Important* and *Very Well Prepared* for Use of Specific Instructional Strategies



Source: Teacher questionnaires

Attitudes Toward and Preparation in Instructional Strategies

Many of the teachers who responded to the questionnaire highly endorsed investigative strategies in mathematics instruction. They rated a variety of these strategies as *very important* for effective mathematics instruction (see Figure 1). Over 80% of the teachers placed high importance on hands-on activities, providing concrete experiences before abstract concepts, making connections between mathematics and other disciplines,

and applying mathematics in a variety of contexts. More than 60% of these teachers reported that they found cooperative learning and inquiry-oriented activities *very important* to effective mathematics instruction. Over half of the teachers valued highly the use of computers in mathematics instruction.

Although many teachers endorsed instructional strategies that characterize standards-based mathematics, fewer teachers felt highly prepared to use these strategies (see Figure 1). Less than half of the teachers reported feeling *very well prepared* to direct students in hands-on activities and cooperative learning, for example. Moreover, less than one-third of these teachers reportedly felt *very well prepared* to facilitate inquiry-oriented activities or to use computers in their mathematics lessons. Thus, according to teachers' reports of their teaching preparation, many lack preparation to teach children successfully through the instructional strategies of standards-based mathematics.

Preparation in Mathematics Content

In general, many of the mathematics teachers reported feeling well prepared to teach mathematics, including the mathematics content traditionally taught in U.S. elementary and middle schools. Many of these teachers (58%) reported feeling *very well prepared* to teach mathematics compared with few (27%) who felt *very well prepared* to teach science. As a majority of these teachers (82%) taught in elementary schools, the mathematics content that they felt comfortable with reflects their work experience (see Table 1). More than half of the mathematics teachers reportedly felt *very well prepared* to teach computation, patterns and relationships, measurement, numeration and number theory, and estimation. Small proportions of these teachers felt *very well prepared* to teach subjects such as probability and pre-algebra, which broaden the mathematical knowledge of elementary students in accordance with current standards. Thus, a minority of the mathematics teachers who responded felt well prepared to teach mathematics content that traditionally has received little attention.

Fewer special education teachers than mathematics teachers reported feeling well prepared to teach mathematics and mathematics content that U.S. elementary and middle schools have traditionally overlooked. One-quarter (26%) of the special education teachers reported feeling *very well prepared* to teach mathematics, whereas less than one-tenth (8%) of these teachers felt *very well prepared* to teach science. Although more than half (56%) of the special education teachers felt *very well prepared* to teach traditional mathematics content, such as computation, approximately one-third of these teachers felt *very well prepared* to teach patterns and relationships, measurement, numeration and number theory, and estimation. Similarly, less than one-fourth of the special education teachers felt *very well prepared* to teach topics traditionally overlooked such as geometry and data collection, and one-tenth of these teachers felt *very well prepared* to teach probability and use calculators and computers in mathematics classes. In sum, a small majority of these special education teachers feel comfortable teaching computation and some felt comfortable with some traditional content. For the most part, these special education teachers do not report feeling prepared to teach any other areas of mathematics, especially areas that expand the curriculum beyond traditional content areas.

Table 1. Percentage of K-8 Mathematics Teachers Prepared in Mathematics Topics

Mathematics Topics	% Not adequately prepared	% Somewhat prepared	% Fairly well prepared	% Very well prepared
Computation	0	6	28	66
Patterns and relationships	0	4	35	61
Measurement	1	9	35	55
Numeration and number theory	0	11	34	54
Estimation	2	8	38	52
Geometry and spatial sense	2	11	42	45
Data collection and analysis	7	16	38	40
Probability	6	27	35	33
Pre-algebra	16	28	30	26
Calculators or computers in mathematics	13	30	37	21
Algebra	29	30	24	16

Source: Teacher questionnaires

Relationship Between Teachers' Attitudes and Preparation

Teachers' endorsement of standards-based instructional strategies could be interpreted in different ways. One hypothesis is that many teachers who have not yet participated in training highly value investigative instructional strategies and would like to use them in their classrooms. Perhaps, these teachers will welcome the new curriculum and instruction. On the other hand, the findings that many teachers are not well prepared to carry out these activities imply that many will require some professional development to be able to implement them in their classrooms. Teachers' endorsement of these instructional strategies in combination with their lack of preparation may suggest that many are eager to learn these types of instructional strategies.

Supporting evidence for the eagerness to learn how to implement standards-based instructional strategies comes from informal conversations with teachers and school administrators. When observing teachers' classrooms, the evaluator learned that kindergarten through fourth grade teachers who were scheduled to participate in ACME professional development in subsequent years of the project were anxiously awaiting the opportunity. One fourth grade teacher said that she had seen what a trained fifth grade teacher had been doing in her mathematics classroom and looked forward to learning more about the new curriculum and instruction herself. A first grade teacher was disappointed to find out that she would have to wait two years before participating in ACME professional development.

Similarly, some schools are not waiting for the planned grade-by-grade implementation to reach all of their teachers. Although the district is committed to buying curriculum materials for all campuses before each grade level begins professional development, ACME program staff reported that some schools have bought the materials with campus funds for all grade levels in advance. Because on some campuses all of the teachers wanted to participate, not just the fifth and sixth grade teachers who were scheduled, schools requested professional development for teachers in other grade levels.

ACME program staff decided that they could not include extra participants, and some school staffs were disappointed. On at least one campus, the administrator hired outside staff developers to teach their teachers, who were not yet targeted for ACME professional development, how to implement investigative mathematics curriculum and instruction.

Thus, it appears that some teachers' eagerness to learn how to implement the standards-based curriculum and instruction may explain, in part, the high level of endorsement of these strategies coupled with their reported lack of preparation to use these strategies. Moreover, the eagerness of some teachers who must wait for professional development suggests that a momentum may build as some motivated teachers anxiously anticipate their turn to participate and to try out standards-based curriculum and instruction.

Another hypothesis is that teachers' endorsement of the standards-based curriculum may reflect familiarity with the language of new trends in mathematics education, but teachers may lack a clear understanding of the implications of these strategies for classroom activities and children's learning. These data were gathered through teachers' responses to questionnaire items. Many teachers may be familiar with phrases like "hands-on activities" or "cooperative learning" and readily rate these items as *very important*. Cohen (1990) found that although teachers may be able to communicate in the language of mathematics reforms, their classroom instruction may be dominated by traditional strategies. Thus, the findings that teachers highly endorse standards-based strategies may be misleading because the data are self-report. Teachers' endorsement does not necessarily imply that these strategies will be evident in their teaching practice.

Other evidence from teachers' questionnaires points to their lack of information about mathematics reforms. Before participating in the ACME project, some teachers in the district were not familiar with NCTM standards. Twenty-two percent of the mathematics teachers and 29% of the special education teachers did not consider themselves well-informed about the NCTM Standards for the grades they teach, and 21% and 32%, respectively, had no opinion. Consequently, 43% of the mathematics teachers and 61% of the special education teachers who responded did not assert that they knew the standards well. Although some teachers who have not participated in the project endorse the language of standards-based instructional strategies, they may not know the philosophy behind the strategies nor how to use the techniques effectively to help children reason mathematically. This finding supports the hypothesis that teachers may be familiar with the language of standards-based strategies, but not understand the implications of these strategies for teaching and learning.

Project staff discerned this lack of knowledge about standards-based mathematics education during the first year of the project. One staff member said,

> *We had to examine where our teachers are. Our teachers didn't know NCTM standards or understand problem-solving. When we launched the professional development, we assumed that teachers knew why "drill and kill" was not O.K. We had to go back and talk about it, go back to the foundations.*

Source: Project staff interviews

Through interaction with teachers in ACME professional development, the mathematics team learned the limits to teachers' knowledge about the NCTM standards and its philosophy and decided to address the lack of knowledge. However, this lack of knowledge supports the supposition that some untrained teachers do not have a comprehensive understanding of the standards-based teaching practice. Again, teachers' endorsement of standards-based instructional strategies may reflect familiarity with the terms rather than a deep understanding of the implications for teaching practices and children's learning.

Similar to some teachers' lack of knowledge of NCTM standards, during the first year of the project, the team recognized limits to teachers' mathematics content knowledge. In teachers' evaluations of how their mathematics content was enhanced by the summer institute of 1998, some acknowledged that they made improvements in this strand over the course of the institute. For example, teachers stated that they gained a "better understanding of math," became "more confident with my own understanding of math," and "learned different ways to approach problems." On the other hand, other teachers stated that they did not gain content knowledge, but described instructional strategies that they gained instead. Thus, in evaluating what teachers learned in professional development, some acknowledged gaining a deeper understanding of mathematics than they had before ACME professional development, but other teachers seemed to emphasize developing new strategies and approaches to solve mathematics problems.

Interviews with the ACME project staff and observations of teachers at professional development suggest that teachers' attitudes toward standards-based instructional strategies are more complex than the responses to questionnaires imply. When the project began in the summer of 1997, one staff member described teachers' attitudes as anxious, apprehensive, and cautious. These attitudes are supported by the observations of hesitance in some fourth grade teachers at the beginning of their first summer institute. Moreover, teachers' attitudes ranged from opposition to the district's approach to curriculum and instruction to interest and desire for support. Thus, behind teachers' endorsement of standards-based instructional strategies, there may be a mixture of anxiety and interest.

Over the course of the first year, the same staff member who noted a range of attitudes also observed a great deal of change in teachers' attitudes toward the new curriculum. At the end of the first year of the project and the second summer institute, fifth grade teachers who attended training showed more confidence and interest in the curriculum and instructional strategies. Additionally, a higher proportion of the teachers were enthusiastic about the project than were the previous summer. Consequently, through professional development, facilitators may have helped teachers become more prepared to teach standards-based mathematics by supporting and addressing their concerns as they tried out the new materials and strategies in their classrooms.

Classroom Instruction in the Baseline Year

To assess the characteristics of classroom instruction in the district, the evaluation included teachers' reports on their practice taken from the questionnaires as well as the evaluator's ratings of classroom observations. In general, most teachers report that their

teaching practices include a combination of investigative and traditional instructional strategies. However, classroom observations reveal that mathematics instruction in the baseline year of the project is generally characterized by instruction that contains elements of standards-based practice but these are primarily ineffective. Many teachers do not yet have the skills necessary to implement the standards. Moreover, a number of teachers emphasize practicing computation for mastery and rote memorization. Despite these general trends, there is evidence that the teaching practices of some teachers include effective standards-based instruction.

Teachers' Reports on Mathematics Instruction

Overall, teachers who responded to the questionnaires emphasized teaching of mathematics in their classrooms.[1] Over 75% of the teachers who taught in self-contained classrooms reported that they teach five mathematics lessons per week. They also reported that the mathematics lessons typically lasted between 41 and 60 minutes for approximately half of the classrooms, 61 minutes or more for about one-third of the classrooms, but 40 minutes or less for about one-sixth of the classrooms. Compared with other subjects, teachers reported that they covered mathematics nearly as often as reading/language arts. When reporting what happened in the last five school days in their classrooms, over 80% of the teachers taught mathematics, and over 90% taught reading/language arts. In contrast, science was taught in the last five schools days by 39% of the mathematics teachers who responded, and social studies was taught in the last five school days by only 28% of these teachers. No special education teacher with a self-contained classroom taught science or social studies in the last five school days. This evidence suggests that in the baseline year of the project most students in the district are receiving mathematics and language arts instruction almost daily and mathematics lasts a considerable amount of time. Science and social studies are covered much less and not at all for students with disabilities. This emphasis on mathematics as well as on reading/language arts reflects district policy to improve children's performance in mathematics, reading, and writing, the three subject areas tested by the state's accountability measure, the TAAS.

Teachers' reports of the characteristics of their instructional strategies echo their endorsement of standards-based practices (see Table 2), although special education teachers reported slightly less investigative practice than general education teachers. However, all teachers' reports of children's classroom activities suggest that the mathematics lessons include traditional practices as well. Most teachers surveyed reported that an investigative culture characterizes their mathematics instruction. For 80% or more of the teachers, their mathematics instruction often or always encouraged children to communicate mathematically, explain their reasoning, explore alternative solutions, and discuss their work. (The responses of special education teachers differed slightly in that a small majority, 74%, of these teachers reported encouraging students to communicate mathematically.) On the other hand, many teachers also reported practices that

[1] This analysis includes only the teachers who taught in self-contained classrooms (188 of the 248 mathematics teachers and 12 of the 39 special education teachers who returned the questionnaires). Some elementary schools in the district departmentalize grade levels such that teachers teach only one or two subjects.

characterize traditional teaching practices. For example, more than 70% of these teachers indicated that their mathematics instruction often or always included children's practicing algorithms and routine computation as well as reviewing homework and worksheets in class. One traditional strategy that these teachers used infrequently was short answer tests; only 19% of the mathematics teachers but 31% of the special education teachers reported assessing children's competence with these tests often or always. Thus, before participating in ACME professional development, many of these teachers reportedly were implementing a combination of traditional and standards-based instructional strategies in their mathematics lessons.

Table 2. Comparison of Teacher-Reported Teacher and Child Behavior in Investigative and Traditional Practice: Percentage Reporting in Each Category

	% Rarely or Never	% Sometimes	% Often or always
Investigative practice			
Teachers' behavior:			
Require students to explain their reasoning when responding	0	9	91
Encourage students to communicate mathematically	4	10	86
Encourage students to explore alternative methods for solutions	3	14	83
Arrange seating to facilitate student discussions	4	12	83
Children's behavior:			
Engage in hands-on mathematical activities	0	9	91
Discuss mathematics with teacher to further their understanding	4	16	80
Share ideas or solve problems with each other in small groups	4	16	80
Work on solving real-world problems	7	19	74
Work on mathematics investigations or projects for a week or more	56	27	17
Work on portfolios	44	34	22
Work on models or simulations	43	33	23
Design or implement their own investigations	39	38	23
Traditional practice			
Teachers' behavior:			
Assign mathematics homework	9	8	82
Children's behavior:			
Practice routine computations/algorithms	7	22	71
Review homework or worksheet assignments	11	17	71
Use calculators or computers for learning or practicing skills	28	35	36
Use calculators or computers to develop conceptual understanding	36	34	31
Take short answer tests (e.g., multiple choice, true/false, fill blanks)	50	31	19
Take tests requiring descriptions or justifications of solutions	38	36	26

Source: Teacher questionnaires

The finding that many teachers reported implementing traditional as well as standards-based strategies could be interpreted in at least two ways. On the one hand, perhaps many teachers divide their mathematics lessons into segments such that one part involves investigative practice and another part involves traditional practice. In the classroom observations, a few teachers indeed divided their mathematics lessons into

segments with both investigative and traditional instructional strategies. For example, one teacher demonstrated how to represent double-digit addition with ones and tens blocks, had her students play an addition game with those materials in small groups, and then passed out worksheets for them to practice computation. On the other hand, it is possible that teachers describe their instructional strategies in the terms of standards-based practice (e.g., encouraging children to communicate mathematically or to explain their reasoning) without understanding how those strategies can be carried out effectively to influence children's mathematics competence.

Further examination of teachers' reports of the activities that children do in their mathematics classes revealed a mixture of strategies (see Table 2). Most of the teachers indicated that children engage in hands-on mathematics activities often or always, and many teachers reported that children solve real-world problems with mathematics often or always in their classrooms. However, some specific classroom activities that distinguish standards-based mathematics from traditional strategies occur less frequently. For example, in less than one-fifth of the classrooms, students often or always worked on an investigation or project that lasted a week or more. In approximately one-fourth or less of the classrooms, students often or always worked on portfolios, models or simulations, or designed or implemented their own investigations. Similarly, in approximately one-fourth of the mathematics classrooms and in one-seventh of the special education classrooms did standards-based assessments in which students provide descriptions or justifications of solutions occur often or always. In contrast, the frequency of children's work with computers and calculators that teachers reported varied.

Thus, teachers described their own teaching as a combination of standards-based mathematics instruction and traditional practice. However, the findings are inconsistent and probably do not reflect true standards-based instruction. Teachers reported that children were infrequently engaged in activities that characterize investigative mathematics in their classrooms and that children often practice computation and review worksheet assignments. It is possible that teachers employ strategies associated with investigative practice while children engage in traditional activities. For example, a child could be completing addition problems and get help from the teacher. During the interaction, the teacher may encourage the child to explain her reasoning and to communicate mathematically. In this way, teachers could report their own behavior and children's activities in terms of both standards-based and traditional practice. In light of these inconsistencies, it is unclear from teachers' self-reports the degree to which standards-based instruction occurs in the district. The following discussion of direct observations from a small random sample of mathematics classrooms in the district illustrates a discrepancy in teachers' self-reports of their teaching practices and what actually takes place in the district's mathematics classes.

Classroom Observations

Ten observations of mathematics classrooms and three observations of special education classrooms provide a snapshot of what teaching practices look like in the ACME project's baseline year.

Most of the lessons observed in general education classrooms (7 out of 10) covered the basic mathematics content of computation and numeration and number

theory. However, some of the lessons (4 out of 10) covered topics that traditionally receive little attention, such as probability and data collection and analysis. The intended purpose of many of the lessons (7 out of 10) was to involve children in higher level thinking through developing and reviewing mathematical concepts. However, some of the observations (4 out of 10) involved traditional lesson designs that focused on children's memorizing facts, practicing computational algorithms, and drilling addition and subtraction for mastery. Therefore, the mathematics content of the observed lessons were more often traditional than standards-based, but the intended purpose of the lessons was more often standards-based than traditional.

Teachers' groupings of the children for most of the class activities varied. In the observed lessons of mathematics classrooms, teachers usually organized the children as whole groups (8 out of 10) or as individuals (4 out of 10). Several teachers also had children work together in small groups or pairs (4 out of 10).

The instructional activities that teachers chose for the observed lessons suggest that before implementation of the project teachers used a combination of standards-based and traditional approaches. Table 3 presents frequencies of instructional activities that were observed in each classroom for a large portion of the lesson. In most of the observed lessons (8 out of 10), teachers led class discussions and involved children in exploration of mathematical topics. In about one-third of the observations, children were passive participants while teachers presented information. For more than half of the observations, children were involved in activities that had investigative qualities. For example, they worked with manipulatives, recorded and analyzed data, or played games to develop knowledge or skills. Traditional practices, such as children's answering textbook or workbook problems, occurred in fewer of the classroom observations.

Table 3. Frequencies of Instructional Activities in Observed Classrooms

Types of activities	Frequency
Class discussion led by teacher	8
Whole group	7
Small groups	2
Investigative activity	6
Work with manipulatives	5
Record, analyze, or represent data	3
Play a game to develop or review knowledge or skills	2
Follow detailed instructions	2
Design an investigation	1
Recognize patterns, cycles, or trends	1
Presentation by teacher	3
Reading, writing, or reflection	3
Working textbook or worksheet problems	3
Practiced a skill using audio-visual materials	1

Source: Classroom observation protocols

Despite the finding that many of these teachers organized their mathematics lessons around hands-on activities, the results of the classroom observations indicate that a majority of teachers were not implementing effective, standards-based mathematics. Although teachers may include manipulatives, the quality of the instruction determines whether the lesson effectively helps children develop mathematical competence. Classroom observations were rated on HRI's (1998) 5-point scale ranging from *effective* to *ineffective* instruction. Level 1 refers to *ineffective instruction* in which there is little evidence of student engagement with mathematical ideas. Level 2 describes *instruction with elements of effectiveness* that has substantial problems in the design, implementation or content of the lesson, and is limited in the likelihood to enhance children's mathematical knowledge. Level 3 refers to *beginning stages of effective instruction* characterized by a few elements of effectiveness that frequently engage children in mathematical concepts, but has some weaknesses. Level 4 reflects *effective instruction* that is engaging for most students, whereas level 5 describes *exemplary instruction* that engages all of the students most of the time and represents the art more than the craft of teaching.

In general, classroom observations in the baseline year revealed variability in the quality of mathematics instruction. Although a few of the observed teachers were already somewhat skilled at standards-based teaching practices, most teachers were not (see Table 4). A couple of the observed lessons were ineffective, and several had only elements of effective instruction. For example, some lessons included children working with manipulatives, but the mathematical concepts central to the activity were hardly addressed and higher order thinking was minimal. The next section will describe several observations that reveal the quality of the instruction found during the observations. The two levels most frequently represented were *beginning stages of effective instruction* and *elements of effective instruction*.

Table 4. Frequencies of Qualities of Mathematics Instruction in Observed Classrooms

Quality of mathematics instruction	Frequency
Level 1: Ineffective instruction	2
Level 2: Elements of effective instruction	4
Level 3: Beginning stages of effective instruction	3
Level 4: Effective instruction	1
Level 5: Exemplary instruction	0

Source: Classroom observation protocols

Beginning Stages of Effective Instruction

In several observations, teachers presented *beginning stages of effective instruction*, but the lesson was limited somewhat in its capacity to enhance the mathematical understanding of most children in the classroom. The following case characterizes the observed lessons that manifest this quality of instruction:

> Using the bean toss activity from the book *Math Their Way* (1978), a kindergarten teacher helped children develop the concept of one-to-one correspondence, and learn groups of numbers that sum to 10. In pairs, students tossed 10 beans (one side red, one side white) from a plastic cup, counted the number of red beans, and recorded the number with a red crayon on a data sheet with 10 blank beans. The students were familiar with the procedure because in previous lessons they had counted and recorded data for smaller sums (i.e., 7, 8, 9). While children took turns tossing and counting the red beans, they confirmed and disconfirmed each other's counting. For example, in one pair a boy tossed the beans and counted, "1, 2, 3, 4, 4, 5." His partner said, "4, 4, 5?" She recounted the beans out loud and got 6. The boys said, "Oh 6!"
>
> As the pairs finished collecting their data, several students taped the data sheets together for each number up to 10 to make a histogram at the front of the class. These children talked to each other and analyzed the data they were gathering, for example, "I think 4 is winning," "Now 5 has more." In a large group, the teacher wrapped up the activity by discussing which numbers (e.g., 4 and 5) occurred most often. Thus, in this lesson, children were actively thinking and processing mathematics with one another. One drawback is that the teacher did not manage the classroom to ensure that most of the children were actively engaged; some children dominated the pair work while others were sometimes off-task.

Source: Classroom observation field notes

This observation illustrates that some teachers are practicing standards-based mathematics instruction effectively even before they participate in ACME professional development. In this observed lesson, the teacher engaged kindergarteners in an investigative activity that involved exploring developmentally appropriate concepts in mathematics (e.g., one-to-one correspondence, counting to 10). Yet, this observation presented areas that need improvement, specifically the teachers' classroom management skills. Finding strategies to ensure that most of the children in the classroom are equally and simultaneously engaged, this teacher could become more effective at teaching standards-based mathematics. Other teachers whose lessons were rated in this category also could improve their effectiveness through the professional development provided by ACME.

Elements of Effective Instruction

The quality of the instruction in several of the observed classrooms was primarily ineffective, but included some elements of effective instruction. The following observation demonstrates the characteristics of this category of instruction.

A teacher had second grade children work with manipulatives to form groups, rows, and stacks of snap cubes (e.g., 3 stacks of 4 or 2 groups of 6) and to represent multiplication and division. On an overhead projector, the teacher presented a table with three columns: number of blocks in a set, type of set (i.e., groups, rows, or stacks), and number of sets. Each child had a copy of the table to keep track of the problems, and each group of four children whose desks were together had a box of cubes. The teacher called on children to choose a number and a type of set. She rolled a die to determine the number of sets. Each child then represented the sets with snap cubes, and the teacher walked around the room checking and correcting their representations.

During the lesson, several children incorrectly represented the sets; the teacher corrected some but ignored others. She paid a great deal of attention to how children laid out their rows. The children's desks were organized in groups of four. Children sitting next to each other looked at children's arrangements, but rarely discussed the problem to make sense of it. Toward the end of the lesson, the teacher suggested that the children help one another represent the problems. A boy tried to help a girl correct her answer by telling her that she had 5 groups when she needed 6, but their box of manipulatives was empty and she was unable to correct her representation. This teacher also tended to ignore girls and call on boys. Moreover, the desks of three boys who had trouble following the assignment were grouped at the front of the room, but the teacher rarely visited their table to guide their thinking and actions. At the end of the lesson, the teacher abstracted the problems with symbols, but did not accept variability in children's accurate responses to her questions.

Source: Classroom observation field notes

This case exemplifies instruction that has a few elements of effectiveness but does not appear to improve the mathematical competence of many children in the classroom. Some children appeared to benefit from representing multiplication and division with manipulatives and were able to link their concrete experiences to the symbolic abstraction at the end of the lesson. However, many of the children in the class did not. Their work reflected a lack of understanding, but the teacher did not successfully address their misunderstandings. Moreover, children's own efforts to help one another were ineffectual, given their apparent inexperience with cooperative learning and the limited materials available for the lesson. This teacher's instructional practices could be improved by acquiring standards-based strategies for classroom management and perhaps more content knowledge of mathematics. These teaching practices also would be more effective if all of the children in her classroom had equal access to instruction and resources. On the basis of classroom observations, a number of teachers observed lack

the instructional strategies necessary for implementing effective, standards-based mathematics.

In addition to improving mathematics teaching and learning in general, district staff would like to explore how standards-based mathematics could improve the performance of students in special education. For the three special education lessons observed, the quality of the instruction contained elements of effective instruction. The following case illustrates characteristics of these lessons.

> A sparsely equipped classroom included five children, a teacher, and a teacher's aide. One fourth grade child worked one-on-one with the teacher to practice multiplication by four with stacks of snap cubes. The teacher asked the child to count how many cubes he had stacked. After the child correctly counted the cubes, the teacher asked how many groups of four he had. The child gave the number, and the teacher stated, for example, "So 6 times 4 is 24." These procedures were repeated for stacks of one to six cubes. Much of the interaction centered on focusing the child's attention, but he was willing to work at times. Much of the teacher's attention was spent constraining and monitoring the behavior of all of the children in the classroom while working with the target child.

Source: Classroom observation field notes

In this observation, the teacher presented some elements of standards-based instruction such as work with manipulatives. However, the interaction was highly structured, and primarily the teacher, not the child, made the connection to multiplication from the groups of snap cubes. Although the teacher designed a lesson with concrete representations of mathematical concepts, other activities might have provided a richer, more interesting learning experience. Relinquishing some of the structure and adapting some of the activities from the curriculum resources may go further in enhancing the learning experiences and understanding of children in special education classes. In the baseline year, the ACME project staff have begun to help special education teachers plan ways to adapt the new curriculum and instructional strategies in their classrooms.

In conclusion, although many of the untrained teachers report that their mathematics instruction includes investigative practice, direct classroom observations contradict their reports. Only a small number of teachers in the observed sample were familiar with standards-based practice and effectively engagd children in investigative activities. According to these ratings, some teachers who have not yet participated in professional development are not effectively teaching mathematics with the strategies outlined in NCTM standards. For the most part, the mathematics instruction in the baseline year of the project was ineffective or contained only elements of effective practice.

Quality of ACME Professional Development

The quality of professional development that the ACME facilitators provided was evaluated primarily from eight direct observations. All observations involved sessions with teachers, except one session with administrators. Feedback from teachers about

professional development came from two additional sources. First, teachers who participated in professional development responded to questionnaire items. Second, teachers who attended the summer institutes of 1998 completed evaluations about those experiences in professional development. At the end of the first year, the project had developed a strong professional development plan that supports implementation of standards-based curriculum and instruction and is responsive to participants' needs.

Observations of Professional Development

The ACME project has planned long-term professional development and ongoing support for all mathematics teachers in the district in accordance with current staff development models, including yearly week-long institutes and continued support during the academic year.

Structure of Professional Development

The ACME project staff have developed what one staff member called "custom-designed" professional development. Project staff members have assembled materials and activities to promote exploration and acquisition of standards-based pedagogy, mathematical content and instructional strategies tailored to the preparation of the district's teachers. The observed professional development sessions addressed classroom pedagogy by modeling effective mathematics instruction, demonstrating how to use materials in the classroom, and examining issues of scope and sequence in elementary and middle school mathematics. In a majority of the observations, facilitators promoted reflective practice. Topics that received little attention in the observed sessions included using computers in classrooms and addressing issues of access, equity, and diversity.

In more than half of the observed sessions, the discussions and activities covered specific mathematics content. The project staff focused on broad topics that go beyond the computation and numeration traditionally taught in classrooms. Computation arose primarily as a tool for solving problems, not as a topic unto itself. The sessions involved a variety of topics such as numeration and number theory, measurement, patterns and relationships, and geometry. Additional topics informally observed included pre-algebra, data collection and analysis, and estimation. The topics of probability, statistics, and calculus were not observed.

Project staff designed professional development to actively involve participants with their peers and to model investigative activities and instructional strategies. In the format of all professional development observations, the facilitator led large group discussions with the participants, and in all but one of these sessions, teachers discussed topics in small groups. In almost all observations with teachers, the participants were involved in investigative activities and problem-solving. In some observations, teachers briefly read NCTM standards or journal articles before discussing the topics in small and large groups. In only one observation, a session for school administrators, did the facilitators primarily present information to the participants.

Quality Ratings of Professional Development

As for the classroom observations of mathematics lessons, the evaluator rated the quality of design, implementation, mathematics content and culture of the professional development observed as well as the quality of pedagogical content. The observations

were assessed on a 5-point scale ranging from *ineffective* to *exemplary* professional development. Level 1 refers to *ineffective professional development* that does not engage participants in ideas of mathematics education and is unlikely to influence their capacity to provide high quality instruction. Level 2 contains *elements of effective professional development* such that participants are sometimes engaged, but the session has substantial problems and is limited in its positive impact on instruction. Level 3 presents *beginning stages of effective professional development* with activities that are sometimes effective in enhancing participants' effectiveness as educators, but has some weaknesses. Level 4 is *effective professional development* that engages most participants in the concepts of high quality mathematics education and influences their capacity as leaders. Level 5 refers to *exemplary professional development* in which the facilitator demonstrates skill and artful orchestration of the session, and enhances the capacity to provide high quality mathematics education and leadership qualities of all participants.

Table 5 presents the means and standard deviations across the 5-point scale for dimensions of the eight professional development observations. Overall, the quality of the ACME project's professional development is effective, but some sessions revealed areas for improvement. In general, the strengths of the observed professional development lie in the design and the culture of the sessions, both of which averaged at level 4. The design included the activities, the roles of participants and facilitators, organization, and resources of the observations that influence the participants' capacities to provide children with effective mathematics education. The culture involved a climate of collaboration, respect, and encouragement of teachers' active participation in sessions.

Table 5. Means and Standard Deviations of Dimensions of Eight Professional Development Observations

Dimensions	Mean	Standard deviation
Design	4.0	0.5
Implementation	3.8	1.0
Mathematics content	3.4	0.5
Pedagogy	3.4	0.8
Culture	4.0	0.5
Overall	3.6	0.4

Source: Professional development observation protocols

Other dimensions of the observed professional development sessions were effective but less powerful. Implementation, or the style in which the facilitator carries out the session, was variable (represented by a standard deviation of 1.0). On the basis of this finding, implementation of some observations was *exemplary professional development*, but the implementation of others presented *beginning stages of effective professional development*. The dimensions of mathematics content and pedagogy had the lowest average ratings (*Mean* = 3.4). It is possible that the variation in implementation is related to the lower ratings for mathematics content and pedagogy. If the facilitator is not highly effective at carrying out the professional development, the communication about mathematics content and pedagogy may be less likely to move participants' understanding

forward. Comparison of the following two observations that represent quality ratings of level 4 and 3 illustrates this point.

Effective Professional Development

The following observation exemplifies highly skilled implementation that supports participants' exploration of standards-based pedagogy.

> This session was the first day of the second summer institute for fifth grade teachers with about 40 participants. The half-day session had four parts. The session began with a journaling activity on participants' thoughts and experiences with mathematics followed by problem-solving in small groups, a reading and discussion of four major NCTM standards of mathematics instruction, and a planning session. A highly engaging group discussion followed each of the first three activities.
>
> In this session, the facilitator skillfully and with energy engaged the participants in high level discussions of investigative mathematics and instructional strategies. She followed the ideas brought out in discussion, summed up what was said, and expanded the concepts. The atmosphere centered on respect for participants, punctuated by warm adult humor. During small group work, the facilitator visited every table to assess their progress and push their understanding forward.
>
> Through personal examples, the facilitator exchanged ideas with participants about pedagogy and shared expertise. For example, in a discussion of sizes of cooperative learning groups, she shared the struggle to find a workable number and welcomed participants to explore possibilities in their own classrooms. In another discussion of mathematics as reasoning, the group addressed strategies for comparing fractions. The facilitator described an instance when a child wanted help carrying out an algorithm that he did not understand. One teacher replied, "Doesn't a strategy mean something that makes sense?" The facilitator said that she did not understand why the algorithm worked. Another teacher said, "If you don't understand, why teach it?" Still another participant challenged the idea because that particular algorithm was the only way that she could get children to compare unequal fractions. Finally, one teacher in the group figured out the logic of the algorithm.

Source: Professional development observation field notes

This observation illustrates how effective facilitation actively involves teachers in professional development. In this example, teachers challenged traditional approaches to mathematics education, explored the meaning of standards-based strategies, and aired

different opinions. The skill level of the facilitator seemed to promote the engagement of participants and to boost their thinking about standards-based pedagogy to high levels. The effective implementation of the session's design and rich cultural climate supported the deep exploration of pedagogy.

Beginning Stages of Effective Professional Development

The next example illustrates how implementation that is not fully effective may hamper the exchange of information between facilitator and participants about mathematical content.

> The facilitator led two activities in a room with 50 fourth grade teachers. First, in small groups, the participants were given eight cards, each with a different competency level in fractions that children should demonstrate at different grades. The groups compared these cards to the state standards (TEKS) to determine to which grade level each competency referred. The next activity involved exploring fraction bars.
>
> This facilitator fostered a warm climate of collaboration and exploration, for example, with jokes and by asking participants if they agreed with the assertion of another. Several times the facilitator made one-way presentations to the group about topics such as the difficulties of coming to a consensus, student mobility in the district, and not accepting documents at face value. The activity with fraction bars was limited to some comparisons and a few points about the properties of the materials rather than examining multiple activities with the bars and discussing how to support children's mathematics understanding through the activity.

Source: Professional development observation field notes

This observation demonstrates how limited implementation may detract from the participants' exploration of mathematics content. The facilitator could have encouraged participants to discuss their expertise and delved more into the development of children's thinking and mathematical concepts embedded in fractions. This facilitator also did not draw out mathematics pedagogy as in the previous example.

In conclusion, the ACME professional development highly involved participants in investigative activity, the exploration of pedagogy, and the acquisition of mathematics content. Overall, the ACME project staff provided effective professional development, although some sessions were somewhat limited in the dimensions of mathematics content and pedagogy. It is possible that by strengthening the implementation skills of some facilitators, the project will improve the mathematics content and pedagogy provided and enhance teachers' capacity to implement standards-based curriculum and instruction.

Teachers' Attitudes Toward ACME Professional Development

Teachers who had participated in ACME professional development reported on their attitudes and experiences. However, these responses must be interpreted with

caution because it appears that many teachers may have misunderstood the items. An introduction to these questions referred to "the NSF-supported Local Systemic Change (LSC) project." The acronyms LSC and ACME were explained in a cover letter that accompanied the questionnaire. However, the responses indicated that teachers may have thought that the items referred to *any* mathematics professional development in the district. For example, over 50% of the teachers who responded indicated that they had received 20 hours or more of LSC professional development. Yet, according to attendance records as of March of 1998, only 14% of the teachers who received questionnaires had attended 20 hours or more of ACME professional development. In an earlier survey, teachers reported that they did not recognize the name of the project as ACME, and in the first year they often referred to the project by the names of the curriculum resources, *Investigations* and *CMP* (Batchelder, 1998). Moreover, prior to the ACME summer institutes of 1998, many teachers did not know that NSF has funded the ACME project, and were probably less familiar with the acronym of LSC than ACME. Because most of the teachers who responded to the questionnaire were not fifth or sixth grade teachers, and many had received professional development throughout 1997 and 1998, the validity of these responses is questionable.

Teachers who reported that they attended "LSC" professional development were asked about the extent of their involvement. In general, a majority of these teachers gave intermediate responses between involved *not at all* and *to a great extent*. Over three-quarters of these teachers perceived some encouragement to develop an individualized professional development plan for mathematics education. Three-quarters or more of these teachers felt supported with time to work with other teachers in professional development, time to reflect on classroom applications, and help in implementing what they learned. In contrast, 29% of the mathematics teachers and 41% of the special education teachers who responded did not feel at all involved in planning their own professional development in mathematics education. In summary, many teachers who responded felt some encouragement and support in their professional development regarding mathematics education, although a number of these teachers did not feel involved at all in the planning.

When asked how the "LSC" professional development increased their knowledge and skills in mathematics, again, most teachers gave responses between *not at all* and *to a great extent*. Over 80% of the teachers reported that participating increased their mathematics content, their understanding of how children think about/learn mathematics, and their ability to implement high-quality mathematics instructional materials. Overall, more than half of these teachers rated the "LSC" professional development as *fair* or *good*, over one-fifth rated it as *very good* or *excellent*, and less than one-fifth rated it as *poor* or *very poor*.

In sum, for most of the teachers who responded to these items, their feelings about the professional development in mathematics education are between positive and negative. As a group, they reported neither strong negative feelings nor strong positive feelings about the project and their participation in charting their own professional development in mathematics education. Nevertheless, because many of these teachers may have misunderstood that these items referred only to *ACME professional development*, it is likely that these findings do not paint a representative picture of how teachers feel about

ACME professional development. These responses possibly included the teachers' thoughts about other mathematics professional development in the district.

Key Features of ACME Professional Development

Curriculum Materials

The ACME professional development provides teachers with a rich opportunity to explore and become conversant with the curriculum resources of the project, *Investigations in Number, Data, and Space* and *Connected Mathematics Project*, in a number of ways, such as modeling lessons and analyzing units above and below grade levels. The project staff also helped teachers become familiar with pacing of units, demonstrated how choice time works, and how to implement partner quizzes. Participants solved problems using nontraditional algorithms, modeled mathematics concepts, and shared strategies for approaching mathematics.

The following example demonstrates how facilitators lead participants in hands-on experiences with specific activities found in the resources.

> In one observation, participants picked up materials for four games from *Investigations* that involved work with whole number computation and fractions: Close to 100/Close to 1000, Double Compare, The Fraction Cookie Game, and Multiple Bingo. They were told to play each game for 10 minutes and to think about the important mathematical ideas behind the games, modifications, additional questions to ask students, and suggestions for colleagues. At the end of the activity, the large group discussed participants' reflections.

Source: Professional development observation field notes

By sampling the games, participants learned logistically how to manage the same activities in their classrooms. They practiced communicating about the materials in small and large group discussions and developed a deeper understanding of the implications for practice and the mathematical ideas behind the games. In the particular observation cited, several teachers came up with variations on the games to further children's mathematical exploration through the activities. Thus, teachers were supported as they tested out materials and developed skills in communicating with colleagues about the curriculum resources.

Additionally, the ACME project staff supported teachers' exploration of the designated curriculum resources by addressing their requests. During the 1997-98 school year, fifth and sixth grade teachers requested time to compare the curriculum resources across grade levels. ACME project staff thus let participants decide what the last follow-up day would look like and designed materials to guide discussions of the similarities and differences in the fifth and sixth grade curriculum resources. Thus, in this example, ACME project staff supported not only teachers' exploration of materials, but also responded to participants' needs to understand scope and sequence in the project's mathematics curriculum across resources and grade levels.

Mathematics Content

A major thrust of the ACME project staff's design of the professional development in the 1997-98 school year was to help teachers deepen their knowledge of mathematics content. Major areas of focus included fractions, decimals, and multiple strategies for approaching mathematical operations (i.e., addition, subtraction, multiplication, and division). Some units on geometry and algebraic concepts were included. Estimation and measurement were sometimes covered as secondary topics. Facilitators also used "ten-minute math" exercises to demonstrate data collection and analysis.

In content areas where the project staff recognized that the designated curriculum resources had gaps at the fourth grade level (e.g., in decimals), the professional development provided participants with supplementary exercises and materials. Through group activities, project staff introduced many tools that support these content areas such as fraction cubes, bars, and blocks; snap cubes; tens and ones blocks; and so on. Some topics such as geometry, measurement, and probability and statistics, were infrequently addressed and could be expanded in future years.

In general, the ACME professional development in the baseline year exposed participants to often neglected areas of mathematics content and helped teachers move beyond the traditional mainstay of computation. The facilitators presented different models for approaching mathematical problems such as drawing pictures. In addition, the project staff facilitated teachers' developing their abilities to "do" mathematics in ways they had never before. The following example reported by ACME project staff demonstrates how one teacher attained algebraic thinking through a professional development activity.

> In small groups, teachers translated data from tables to graphs and talked about the relationships between the two formats. They used the numbers in the tables to describe the relationships in words. Then they expressed the data in equations. At the end of the exercise, one teacher reported that he had never understood before how people got equations from numbers and patterns.

Source: Project staff interviews

This example illustrates how a teacher gained the ability to carry out a mathematics procedure that he had not been able to do before from the ACME professional development. This teacher acquired knowledge and skills that he can now take back to his classroom and share with his students.

Pedagogy

A strong point of the ACME professional development is the depth and complexity in its approach to standards-based pedagogy. This point is powerful because central to standards-based practice is an understanding of the underlying philosophy and how this practice differs from traditional practice. As mentioned previously, in the first year, project staff recognized that most teachers did not understand NCTM standards for mathematics education. In the summer institutes of 1998, the staff designed an activity for all participants—newcomers and trained teachers alike—to reflect on and come to

consensus with their peers about the meaning of mathematics as problem-solving, communication, reasoning, and connections to other disciplines. Other topics addressed included asking questions to promote children's mathematics competence, journal writing to encourage reflection, and transforming ideas of reforms in mathematics education.

Assessment

The standards-based assessment strategies that accompany this pedagogy is an area of major concern for teachers. Grading and assessment emerge often in participants' questions to facilitators and evaluations of ACME professional development. A major struggle for teachers has been adjusting their grading to performance-based assessment. As noted only one-quarter of the teachers who responded to the questionnaires reported that their students took tests that required descriptions or justifications, which are characteristic of investigative practice, often or always (see Table 2 in Classroom Instruction in the Baseline Year). As a result, teachers who have not received professional development in how to develop such assessments may be at a loss for how to proceed. In ACME follow-up professional development in the Spring of 1998, an example of how ACME project staff is supporting teachers in their struggle with assessment occurred when fifth grade teachers brought in student work that they had evaluated with rubrics. A rich discussion of students' reasoning, problem-solving strategies, and mathematical understanding ensued. To address teachers' concerns, project staff should expand and allocate more time for this sort of activity in future follow-up sessions.

Generally, in the first year of the ACME project, the professional development provided participants with opportunities to explore and deepen their knowledge of the designated curriculum materials, mathematics content, and effective pedagogy. The project has some room for improvement in various areas. For one, some facilitators implement the professional development more proficiently than others. Taking steps to strengthen the skills of staff who are less experienced than others could not only improve implementation but also the delivery of mathematics content and pedagogy. Another area of improvement could be to build on the basic mathematics content already addressed with more diverse topics. Assessment is another area to consider expanding and devoting more time to in follow-up sessions.

Support for Teachers' Implementation

By design, ACME professional development supports teachers as they try out the curriculum materials in their classrooms. As noted, the professional development plan is extensive and intends to involve each teacher for three years. In addition to two years of summer institutes and follow-up professional development during the school year, teachers participate in one year of support on their campuses. These follow-up sessions provide opportunities for teachers to bring in their experiences from their classrooms and share with their peers. Teachers also exchange strategies that they used for classroom management, assessment, student grouping, differentiation, and problem-solving. For example, project staff reported that teachers brought in factor pairs for the number 1100, looked at all of the different strategies, and compared them. Although the project team orchestrated this activity, the team stepped back and the participants took over by pointing out how other teachers' students were approaching the problem.

ACME project staff have adopted other strategies to support teachers in implementing the new curriculum materials. A substantial area of support for implementation was allotting teachers planning time during professional development and providing an opportunity for them to share with their colleagues. On the teacher questionnaires, 67% of the mathematics teachers and 77% of the special education teachers who responded reported that they did not have time during the regular school week to work with their peers on mathematics curriculum and instruction. In evaluations of professional development and in direct conversation with facilitators, participants requested time to plan with their peers. Thus, project staff integrated this activity into the plan of professional development sessions. In addition to planning time to support implementation, project staff laid out suggestions for the order of units and number of days to spend on each unit as well as basic structures for mathematics lessons. Project staff also supplied participants with supplementary materials to carry out activities in their classrooms, such as card stock copies of activity pieces from the resources.

In addition to support in professional development, ACME project staff are beginning to provide teachers with more personal, informal support. In the Fall of 1998, the ACME project staff began devising a method for team teaching with teachers in the district. The purpose of this plan is to provide campus-based support and to allow staff to return to classrooms, but also to develop strategies to support teachers who are attempting to implement the standards-based curriculum and instruction on their campuses. Because the project staff consists of eight mathematics specialists who cannot reach personally the more than 2000 mathematics teachers who will participate in ACME professional development, the project must enlist more facilitators. Perhaps staff could adapt this model of peer coaching to teachers and develop strategies to support more teachers districtwide.

Quality Facilitation

At the end of the first year of the ACME project, the professional development facilitators consisted of eight mathematics specialists. Project staff reported that all team members were hired because they were outstanding mathematics teachers, demonstrated leadership on their campuses in mathematics education, and implemented a standards-based curriculum in their classrooms. Every one had experience providing professional development to other teachers through the district, regions of the state, and/or national organizations, although some had more experience than others. Additionally, every team member developed their own professional development by attending conferences and workshops where they received training and information that they brought back to the classroom.

In the first year, the ACME project essentially had no teacher leaders to facilitate professional development. At that time, the project staff was able to handle the demand. This plan was devised in collaboration with the Dana Center to avoid the diffusion of knowledge and skills that can occur when information passes through multiple trainers with different levels of expertise. However, to continue the project as planned, ACME project staff recognize that teacher leaders will need to be added to help with professional development in the Summer of 1999 because the number of teachers attending will increase as grade levels are added. As the cross-site evaluation of local systemic change

suggests (Weiss, Rapp, & Montgomery, 1997), the quality of professional development that teachers receive may decrease. ACME project staff should take steps to ensure that teacher leaders are well trained for their roles and that they are motivated to become leaders in mathematics reform.

Development of Professional Learning Community

Several components of ACME professional development foster a learning community of professionals. The ACME project staff of eight members together comprise a community of learners. As one staff member stated, the team has a "focused vision," use the "same language," and is "philosophically aligned." The team has a culture of learning and supportive collegiality. The team's vision and enthusiasm for learning spreads to participants in professional development. The team encourages participants to build on the community by presenting itself as an accessible resource and by drawing upon the experiences of teachers to facilitate rich discussion during professional development.

One facilitator opened a summer institute with an invitation for participants to interrupt and an impromptu question and answer period. This climate inspired participants to share and support each other. Another observation of fourth grade teachers' summer institute began in the following way:

> Before a planned activity, one teacher stated, "Sometime before we leave, I'd like to hear somebody who's used *Investigations* talk about how to use it." The facilitator suggested a panel discussion, but then took a secondary role as teachers launched into a 45-minute exchange about their experiences using the curriculum resources. [Although fourth grade teachers are scheduled to begin implementation in the 1998-99 academic year, some schools have forged ahead of the ACME project's plan.]
>
> What ensued was a rich exchange between participants about the trials and tribulations of trying out the curriculum. One teacher said, "I trained students in cooperative strategies." Another said, "One thing that was very difficult is having kids talk.... You build on it every day." Still another shared, "I started at the beginning of the year. I decided to do everything as in the book. By January, I was convinced this was better than what I did before." Teachers mentioned letters in the back of the book to send to parents to explain the curriculum as well as how children picked up alternative problem-solving strategies from each other. The open conversation continued as teachers new to the curriculum asked others how they handled substitutes, homework, and differentiation for children with different levels of competence.

Source: Professional development observation field notes

This observation illustrates how the environment that the ACME facilitators have established for professional development can set the stage for a powerful exchange between adult learners. In this example, the community of learners ignited spontaneously

by sharing essential information and supporting one another. The ACME project provided a forum in which teachers themselves addressed concerns about implementing the new curriculum and instruction. To further guide the development of a professional community of learners and to foster ownership in the community, ACME project staff need to recognize similar events as they emerge.

Another format for developing a community of learners in the original design of the ACME project was to foster support among teachers on every campus. Thus, in the first year of the ACME project, grade level teams attended follow-up sessions during the school year together. This design allowed campus teams to take their shared learning experiences from professional development back to their campuses and expand on them. Although many teachers appreciated this arrangement, some teachers and school administrators did not feel comfortable with all teachers from one grade level being away from their campuses on the same day. To accommodate this concern, ACME project staff planned a variety of follow-up options, including release time during the day and afternoon and Saturday sessions. These options allow campuses to continue to attend together.

In sum, as ACME project staff support implementation and contribute to the development of a professional learning community, the strengths emerge in the flexible character of the staff and their willingness to take stock and make adjustments in the plan. However, one point to consider is the size and scope of the project. In a growing urban district, ACME project staff cannot address every need or concern that arises. In the team's August retreat, a major theme that arose was sharing responsibility for the project. Teachers, parents, administrators, central office staff, board members, and other stakeholders in the community can also take a lead to help make the project work. Project staff needs to take note of where initiative and motivation may be emerging across the district. While the staff could remain a resource for support and ideas, recognizing interest, enthusiasm, and devotion to the new curriculum and resources could help share the responsibility for making the project work.

SCHOOL AND TEACHER INVOLVEMENT

The level of school and teacher involvement in the ACME project is generally proceeding on schedule. Most of the first cohort of fifth and sixth grade teachers have participated in two summer institutes and follow-up professional development sessions during the 1997-98 school year. In the summer of 1998, the second cohort of fourth and seventh grade teachers attended their first institute, and many school administrators attended sessions to promote campus-based leadership and support for the project. In addition, the ACME project staff have encouraged involvement by keeping teachers and administrators informed of professional development schedules through letters and brochures. However, the level of school and teacher involvement in the ACME project's first year has not been complete, which may be due in part to the difficulty of reaching all of the possible participants in a project of this scope.

Teacher Involvement

In general, all 83 elementary and middle schools in the district, except one school, have teachers who have participated in some ACME professional development. In addition, most teachers from the targeted grade levels have participated in some ACME professional development. Although district employee records are not always accurate

because teachers' positions change from year-to-year and changes are not always updated, estimates support a high level of involvement. Out of approximately 60 sixth grade and 60 seventh grade mathematics teachers, attendance at the summer institutes of 1998 was nearly 100% of the teachers. Out of approximately 250 fourth grade teachers, attendance was about 90% of the teachers for the first week and about 80% of the teachers for the second week of their first summer institute. Similarly, out of approximately 270 teachers from pilot schools, 90% of the teachers attended their first summer institute. However, out of approximately 250 fifth grade mathematics teachers, approximately 40% attended the second summer institute.

The low attendance rate for fifth grade teachers in the summer of 1998 could be explained by departmentalization. In up to 20% of the district's elementary schools, fifth grade teachers teach either mathematics and science or language arts and social studies. Yet, departmentalization does not completely account for this low attendance rate. Project staff reported that some fifth grade teachers reported that they did not attend the second summer institute because they "were already trained." Because the ACME project staff do not want this belief to persist, staff members have taken steps, such as calling and visiting schools, to clear up misunderstandings about schedules and the ACME professional development design. Consequently, enrollment of fifth grade teachers for the first follow-up of their second year in the project is up to about 75% of the teachers.

All of the teachers who participate in the ACME project teach at schools that serve a diverse population of students. In the principal questionnaire, school administrators reported that racial and ethnic make up of students in the district's schools were on average 46% Hispanic, 35% White, 20% African American, 2% Asian or Pacific Islander, and 0% American Indian or Alaskan Native, although the composition of each school varied across campuses. Principals also reported that 19% of the students had limited English proficiency and 61% were eligible for free or reduced lunches on average, although this percentage also varied across campuses. Thus, the ACME project is reaching schools with diverse ethnic/racial backgrounds, language proficiency, and family socioeconomic status.

The K-8 mathematics teachers who are targeted to participate are primarily female and White or Hispanic. Among the teachers who responded to the questionnaire, 95% of the mathematics teachers and 90% of the special education teachers were women and 5% of the mathematics teachers and 10% of the special education teachers were men. The racial or ethnic backgrounds of the mathematics teachers and special education teachers were, respectively, 61% and 76% White, 27% and 11% Hispanic, 9% and 5% African American, 1% and 5% Asian, and 2% and 3% with other backgrounds. One-third of the mathematics educators had taught for five years or fewer, 18% for 6-10 years, 30% for 11-20 years, and 19% for 21 years or more. A larger proportion (50%) of special education teachers were had taught for five years or fewer. Seventy percent or more of all teachers who responded had completed three or more semesters of mathematics courses in college.

Principal Involvement

Principal involvement in the project is in its seminal stages. When the principal questionnaire was distributed in the Spring of 1998, a few principals were not familiar with

the ACME project and did not respond to questions about it. Just 39% of the principals who responded to these items reportedly were familiar with the project *to a great extent*. Some principals (29%) reported a high level of involvement with the ACME project, whereas about the same number (25%) reported that they were *not at all* involved.

In the summer of 1998, the ACME project staff began developing the campus leadership component that was part of its original plan. In the first year, project staff noticed that teachers were more knowledgeable about standards-based curriculum and instruction than were campus administrators. To address this imbalance, project staff planned three different two-day sessions for administrators to attend to learn about the new mathematics program, suggestions for leading teachers in implementation, and address parent and community concerns. After low attendance at the first session, project staff sent letters to administrators who were scheduled to attend the remaining sessions as reminders. At the beginning of the school year, because so few administrators had attended two days of the sessions, the deputy superintendent again required those who had not completed the sessions to attend make up sessions.

Although a few principals in the district may be knowledgeable of NCTM standards and what standards-based instruction should look like, for the most part principals in the district are just beginning to learn about them. An observation of the second professional development with administrators revealed that their concerns centered on organizing materials rather than on deepening their knowledge about curriculum and instruction. In response the facilitator's request for questions or concerns about the standards, principals asked about buying student books that accompany *Investigations*, preparation of materials in Spanish, and the delivery of materials to campuses. As the session continued, discussion returned to planned topics such as how the new curriculum and state standards are aligned, what standards-based curriculum looks like, and how to address parent concerns.

In conclusion, school and teacher involvement is high, but transitioning. Nearly every school in the district has teachers who have attended ACME professional development and those schools serve a diverse populations of students. A majority of the teachers who are targeted to attend ACME professional development have participated, although in the second summer session the attendance of fifth grade teachers tapered off. Principal leadership in the project is in its seminal stages, and will require continued effort to increase and maintain the level of involvement.

SUPPORTIVENESS OF DISTRICT AND SCHOOL CONTEXTS

Central to NSF's support for Local Systemic Change initiatives is the assumption that enhancement of curriculum and instruction does not take place solely with teachers and in classrooms. State and district policies, parents, principals and other forces that impinge on classroom instruction should influence teachers' attempts to provide standards-based teaching and learning to all students. At the end of the first year, the ACME project was transitioning toward a supportive context with some policies and practices aligned with its vision and efforts underway to alter major barriers.

Support for Teachers from Colleagues, Principals, Parents, and the Community

In general, teachers in the district are collegial and prepared to support one another and work together for mathematics reform. Most teachers (86% of mathematics

teachers and 73% of special education teachers) who responded to the teacher questionnaires reported that they felt supported by their colleagues to try out new ideas in teaching mathematics. A majority of all teachers (over 60%) who responded felt that teachers in their schools had a shared vision of effective mathematics and regularly share ideas and materials related to mathematics. Although for many of the district's teachers collegiality was high, time to work together was not a readily available resource. Less than one-fourth of all teachers who responded felt that they had time during the regular school week to work with peers on mathematics curriculum and instruction.

Teachers who responded generally felt that their principals supported their efforts to improve mathematics education and collaborate with their peers on innovations, although special education teachers perceived somewhat less principal support than general education teachers. Most teachers (87% of mathematics teachers and 77% of special education teachers) felt supported by their principals to try out standards-based mathematics curriculum and instruction. Less half of the teachers who responded reported that their principal provided teachers time to meet and share ideas together, and some (40% of mathematics teachers and 30% of special education teachers) felt that their principal encouraged them to observe exemplary mathematics teachers. Moreover, a majority of the principals thought that these resources supported teachers. To encourage effective instruction, 67% of the principals supported giving teachers time for planning and preparation, 81% endorsed opportunities for teachers to work together, and 90% supported time for teachers to attend professional development. Thus, most teachers feel that their principal supports their efforts to adopt standards-based teaching practices, and most principals believe that the resources available influence the quality of instruction. However, a minority of teachers feel that their principal provides the resources necessary to successfully implement standards.

In general, campus administrators responded to the principal questionnaires with a great deal of support for standards-based curriculum and instruction. Like teachers, principals highly endorsed investigative instructional strategies. Most principals (83% or more) considered investigative instructional strategies, such as cooperative learning groups, hands-on and inquiry-oriented activities, and performance-based assessment, *very important* for mathematics education. Almost all of the K-8 principals (89% or more) reported that they were knowledgeable of national standards for mathematics education, well-prepared to support their teachers in implementing the standards, and could accept the noise that emerges from an active classroom. As discussed in the previous section, many principals are just becoming knowledgeable of the full implications of these strategies for teaching and learning. The positive attitudes reported suggest that as principals learn more about standards-based mathematics, many could become a powerful force in the districtwide implementation. In interviews, ACME project staff acknowledged the many pulls on principals' time that could distract some from fully supporting the project on their campuses.

Parents reportedly provided teachers little support in school and classroom activities, and special education teachers received much less parental support than did mathematics teachers. Most teachers (32% of mathematics teachers and 63% of special education teachers) who responded reported that few or none of their students' parents attend PTA meetings and family math nights. Although many teachers (61% of

mathematics teachers and 84% of special education teachers) reported that few or no parents voice support for investigative approaches to mathematics instruction, a similar number of teachers (47% of mathematics teachers and 66% of special education teachers) reported that few or no parents voice support for traditional approaches to mathematics instruction. Thus, teachers, particularly special education teachers, do not perceive much support or opposition to any kind of mathematics instruction from parents. Yet, in professional development teachers recounted stories about how a few parents challenge the standards-based mathematics curriculum and instruction.

Support for the ACME project from parents and teachers is mixed as one ACME staff member reported. In the fall of 1997, after fifth and sixth grade teachers had attended the first summer institute, staff members attended a parent night at two different schools. At one school, teachers had garnered the parents' support *against* the project, whereas at the other school the project staff was invited to provide information about and guidance for the project. These two examples suggest that support for reform in mathematics education is in transition and involves both barriers and facilitation.

From the point of view of the ACME project staff, attitudes and beliefs of teachers, principals, and central office staff that support reforms in mathematics education are present but not quite ideal. The support from district staff is often verbal, but not action-based. Support from the community is more mixed than it is within the district. Although some campuses have been quite successful at engaging the community in meaningful ways, others are just beginning to recognize the importance of this source of support. The ACME project's connections with institutes of higher education and other community stakeholders are cohesive at some points, but at not other points. The role of this external support is usually advisory.

Thus, from this evidence, it appears that more teachers would be better able to implement standards-based curriculum and instruction with increased support from colleagues, principals, parents, and the community. Special education teachers report even less principal and parent support than general education teachers. Designing intervention strategies to buoy up these points of support is a challenge facing the ACME project staff.

District Policies and Practices

Some of the strongest supports of the ACME project are district policies and practices, including the quality of instructional materials, system for purchasing and managing materials, curriculum scope and sequence, and alignment with other reforms. From the perspective of the ACME project director, the district clearly supports the ACME project with materials: "The bottom-line is that no expense is too great." The district is purchasing high quality materials and curriculum resources for all of the district's schools and for all special needs, such as bilingual, ESL, and special education classrooms. The district's adopted mathematics curriculum as well as the state standards the Texas Essential Knowledge and Skills (TEKS) are all aligned with national standards. Moreover, the reforms in mathematics are aligned with the district's efforts in literacy and science education.

On the other hand, the statewide and districtwide methods of assessment, have a mixed impact on the efforts to reform mathematics in the district. The state accountability

test the Texas Assessment of Academic Skills (TAAS) is clearly high stakes. Schools are rated according to student performance on the TAAS in reading, writing, and mathematics, and local newspapers publish the results of these ratings. The test consists of word problems with multiple choice responses and is not directly aligned with the performance-based assessment of national standards for children's mathematics competence. The ACME project director reported that while some teachers in the district are interested in performance-based assessment, TAAS is the only means of assessment for others. The TAAS test puts a great deal of pressure on teachers so that their experimenting with other forms of assessment raises anxiety. The ACME staff reported that they knew that teachers would have questions about how standards-based curriculum and instruction prepare students to perform well on the TAAS. Consequently, in professional development, ACME staff helped teachers understand that the test is designed around the TEKS state standards and meets the expectations of TAAS.

Thus, although district practices and policies tend to facilitate the ACME project, the state and districtwide assessments put a stress on full implementation of standards-based mathematics curriculum and instruction.

INSTITUTIONALIZATION OF PROFESSIONAL DEVELOPMENT SYSTEM

Whether high quality professional development will continue in the district after the ACME project ends is a question of institutionalization. In its first year, the project has developed an emerging infrastructure for a high quality professional development system in the district. Many components of the system are in place, and efforts to modify other components are underway.

A major strength of the ACME project is that it fits into the district's current system of professional development but expands and develops the system. A hindrance to the ACME project is that its staff provide professional development on top of their other duties as the district's mathematics specialists. Similarly, teachers who would be leaders in the project would have to add leadership responsibilities to their work as teachers. Time and financial constraints thus limit the capacity of ACME staff and teacher leaders to provide high quality professional development to the district's teachers and administrators. Nonetheless, the quality of professional development that the ACME project currently offers sets a precedent for other projects in the district to follow.

The merging of other resources available to support ongoing, high quality professional development is in a transitional phase. Recently, central office administration has attempted to open communication about aligning the expenditure of federal and district funds with district policy including the standards-based mathematics curriculum and instruction. These efforts initially were met with both enthusiasm and opposition. Through these efforts, tension emerged between the district policy of campus-based management and other district mandated policies such as the ACME initiative to reform mathematics education. Simultaneously, principals receive authority to manage their own campuses and a mandated project to change mathematics curriculum and instruction.

The structures to sustain high quality professional development are in the initial stages. Incentives for all K-8 mathematics teachers to participate in ongoing professional development at the school and district level and for all new K-8 mathematics teachers to be oriented to standards-based curriculum and instruction are being refined. The central

office staff have recently launched an evaluation to assess and improve professional development that the district provides, and examine the links between professional development and classroom implementation. Although the structures for high quality professional development are in place, there is considerable room for improvement.

SUMMARY AND RECOMMENDATIONS

This report presented information about the progress of the ACME project in its baseline year. It pulls together information from the perspectives of mathematics teachers, principals, program staff and district administrators as well as from observations of classrooms and professional development sessions. At the end of the first year, the ACME project evaluation revealed strengths that will propel efforts to bring high quality standards-based mathematics education to all children in the district and challenges that need to be addressed to promote districtwide implementation.

STRENGTHS OF ACME

The major strengths of the ACME project in the baseline year include the following:

- Most teachers who have not yet participated in ACME professional development and school administrators are familiar with the language of investigative mathematics and highly endorse its teaching practices. Consequently, the eagerness of some teachers and schools to participate in the ACME project may provide momentum for implementation throughout the district.
- During the ACME project's first year, project staff reported a transformation in teachers' attitudes toward investigative teaching practice among those who participated in its summer institutes and follow-up professional development sessions. Teachers' attitudes changed from anxiety, apprehension, and caution to interest and confidence in standards-based practice. Continuing to support this sort of transformation with teachers who are new to the project should further encourage teachers to try to implement the standards.
- A strong point of ACME professional development was the extensive and primarily effective facilitation provided, particularly creating the investigative culture and design of the observed sessions. Across the board, in the first year, facilitators successfully modeled strategies that teachers could adapt in their classrooms and provided a rich collegial environment in which teachers could explore standards-based curriculum and instruction.
- The ACME team forms a community of learners with a shared vision and value for quality mathematics education. This energy stimulates teachers and encourages their collaboration, within and across campuses. The team's effort to correct issues as they arise constantly further renders the ACME project flexible and in tune with teachers and administrators in the district. The team's responsiveness to teachers' concerns and needs as they try out the standards-based curriculum and instruction allows teachers to modify their own professional development.
- A major strength of the ACME project is the alignment of district policies and curriculum as well as the financial and material backing for the project.

CHALLENGES OF ACME

The ACME project in its baseline year faces the following challenges in promoting implementation districtwide:

- Teachers' and principals' familiarity with the language of investigative mathematics may conceal a lack of deep understanding of NCTM standards and implications for effective practice and students' mathematical competence. Although teachers and district administrators may communicate in the language of mathematics reforms, their practice may not reflect the same level of understanding. One of the ACME project's challenges is in determining where more understanding is needed.
- Teachers who had not participated in ACME professional development described their classroom instruction in the baseline year as including both investigative and traditional practice, which may indicate incomplete standards-based instruction. Special education teachers reported somewhat less investigative practice and activities in their classrooms than did mathematics teachers. Although a majority of teachers characterized their teaching practices as including investigative strategies, observations of a random sample of mathematics classrooms in the district revealed instruction that was primarily ineffective as defined by Horizon Research Inc. with elements of effective practice and, in a few cases, effective instruction. The project's challenge is to help as many teachers as possible understand and put into practice effective standards-based strategies.
- Another challenge of the ACME project is to raise the quality of implementation, mathematics content, and pedagogy that all facilitators provide to the level of *effective professional development*. This task may pose a serious challenge as the project adds teacher leaders who may have less experience and fewer skills than current ACME staff.
- Maintaining teacher involvement through the years of planned professional development is also a challenge of the project, particularly because the staff development literature shows that it takes several years for teachers to make new teaching practices their own. Additionally, ACME project staff need to garner full involvement and leadership from more school administrators as research shows principals are pivotal in implementing innovations.
- Teachers and principals need to develop time and arrangements for teacher collaboration on the standards-based mathematics curriculum and instruction while accommodating daily campus functioning. In addition, schools need to continue to develop methods to promote more parent involvement in their children's mathematics education, especially in special education classes.
- A particular challenge to the success of the ACME project is the high stakes state and district assessment system.
- A final challenge to the district is to support structures that will sustain the high quality professional development after the ACME project is complete.

RECOMMENDATIONS

The strengths and challenges of the ACME project in its first year derived from the findings of this evaluation suggest the following actions:

- Foster in the district's teachers, principals, central office administrators, and community an understanding of the difference between superficial implementation and standards-based instruction that enhances children's mathematical competence. As with the ACME project's development of a peer coaching system, the focus should be on identifying teachers and principals who have an understanding of the complexity of standards-based mathematics education and implications for practice and on developing networks for one-on-one or team teaching and learning. Some campuses have teachers and principals who are already fulfilling or could adopt this role, including formal leaders (i.e., curriculum specialists) and grass roots leaders such as teachers who have become inspired by standards-based curriculum and instruction. To reach every campus and teacher in the district, this effort may involve one hundred staff members.
- Continue to address teachers' various attitudes toward implementation through the Concerns-Based Adoption Model (CBAM; Loucks-Horsley & Stiegelbauer, 1992). This research-based model approaches the adoption of an innovation as an individualized processes and presents change as possible in a context that is responsive to individuals' changing concerns.
- Continue to provide teachers and principals with high quality professional development that addresses standards-based pedagogy, mathematics content, and instructional strategies. Continue to support the professional community of learners that is emerging in professional development and on campuses.
- Encourage ACME staff and teacher leaders to improve their skills as facilitators by developing and carrying out a professional development plan and attending conferences and workshops on adult learning and leadership.
- Continue to communicate monitor the importance of full participation of teachers and administrators in ACME professional development.
- Every campus should make use of time set aside for teachers to collaborate on mathematics education. During professional development and other meetings, teachers and principals could share innovative collaborative practices across campuses.
- The ACME staff need to continue public relations to address the concerns of principals and teachers about the relationship between standards-based mathematics education and the district and state assessment system.
- Lessons learned from the ACME project's extensive professional development system could be exchanged with the district's department of professional development to promote and develop a powerful, self-sustaining program.

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APPENDICES

Form Approval OMB No: 3145-0161 Expires: Sept. 30, 1998

Local Systemic Change *through* Teacher Enhancement

1998 Teacher Questionnaire

K-8 Mathematics

For office use only

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The National Science Foundation's Local Systemic Change (LSC) through Teacher Enhancement Program's Core Evaluation

You have been selected to participate in the nationwide evaluation of the federally-funded Local Systemic Change (LSC) program. LSC is a National Science Foundation Teacher Enhancement program that is currently funding over 50 local projects that offer science and mathematics professional development to teachers in 24 states around the country. The cover letter accompanying this questionnaire identifies the LSC project in your area.

A variety of strategies

The general purpose of LSC projects is to offer teachers high-quality professional development in content and pedagogy. These activities are based on the national standards for reforming science and mathematics education. LSC projects are reaching teachers in grades K-12, although most local projects focus on either elementary or secondary teachers. LSC initiatives are helping teachers around the country to implement quality science and mathematics curriculum materials. The size, strategies, and activities of the individual LSC projects vary widely based on local needs.

The national evaluation

The National Science Foundation is accountable to Congress for the programs it funds, and the purpose of the LSC core evaluation is to provide both the leadership at NSF, and ultimately Congress, with information about the quality and impact of the Local Systemic Change program. This national evaluation is a system fo collecting similar information from all LSC projects through various means, including teacher and principal questionnaires. A small number of randomly-selected teachers in each project is asked to provide additional information in interviews, sometimes in conjunction with a classroom visit. In order to continue receiving federal funding, each LSC project must participate in this national evaluation.

This questionnaire

Each LSC project will administer questionnaires each spring to a randomly-selected sample of teachers who are targeted to participate in the local project's professional development activities. (A different group of teachers will be selected each year, but there is a chance over the course of several years that you could be selected to participate again in the future. For statistical reasons, some smaller LSC projects must administer this questionnaire to each participating teacher annually.) Note that you may be asked to complete this questionnaire even if you have not yet participated in the project's professional development; your response i important, regardless of whether you have already participated.

Confidentiality

Data collection procedures have been developed to ensure high quality data and protect teacher confidentiality. Your responses will be kept strictly confidential; they will be combined with the responses of the other teachers in your project and used only for the LSC evaluation. The name label and numbering o this questionnaire are used to help local projects deliver questionnaires to the proper teachers and follow up with teachers that have not responded; no information identifying individual teachers will be reported under any circumstances. After you complete the questionnaire, you should remove the name label and return the questionnaire as specified by your local LSC project.

Thank you very much for participating in this survey!

Instructions: Please use a #2 pencil to complete this questionnaire. Darken ovals completely, but do not stray into adjacent ovals. Be sure to erase completely any stray marks.

A. Teacher Opinions and Preparedness

1. Please provide your opinion about each of the following statements. (Darken one oval on each line.)

Strongly Disagree
Disagree
No Opinion
Agree
Strongly Agree

a. Students generally learn mathematics best in classes with students of similar abilities.	① ② ③ ④ ⑤
b. I feel supported by colleagues to try out new ideas in teaching mathematics.	① ② ③ ④ ⑤
c. Teachers in this school have a shared vision of effective mathematics instruction.	① ② ③ ④ ⑤
d. Teachers in this school regularly share ideas and materials related to mathematics.	① ② ③ ④ ⑤
e. Teachers in this school are well-supplied with materials for investigative mathematics instruction.	① ② ③ ④ ⑤
f. I have time during the regular school week to work with my peers on mathematics curriculum and instruction.	① ② ③ ④ ⑤
g. I have adequate access to calculators for teaching mathematics.	① ② ③ ④ ⑤
h. I have adequate access to computers for teaching mathematics.	① ② ③ ④ ⑤
i. I enjoy teaching mathematics.	① ② ③ ④ ⑤
j. I am well-informed about the NCTM *Standards* for the grades I teach.	① ② ③ ④ ⑤
k. The mathematics program in this school is strongly supported by local organizations, institutions, and/or businesses.	① ② ③ ④ ⑤

2. In the left section, please rate each of the following in terms of its **importance** for effective mathematics instruction in the grades you teach. In the right section, please indicate how **prepared** you feel to do each one. (Darken one oval in each section on each line.)

	Importance				Preparation			
	Not Important	Somewhat Important	Fairly Important	Very Important	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Provide concrete experience before abstract concepts.	①	②	③	④	①	②	③	④
b. Develop students' conceptual understanding of mathematics.	①	②	③	④	①	②	③	④
c. Take students' prior understanding into account when planning curriculum and instruction.	①	②	③	④	①	②	③	④
d. Practice computational skills and algorithms.	①	②	③	④	①	②	③	④
e. Make connections between mathematics and other disciplines.	①	②	③	④	①	②	③	④
f. Have students work in cooperative learning groups.	①	②	③	④	①	②	③	④
g. Have students participate in appropriate hands-on activities.	①	②	③	④	①	②	③	④
h. Engage students in inquiry-oriented activities.	①	②	③	④	①	②	③	④
i. Use calculators.	①	②	③	④	①	②	③	④
j. Use computers.	①	②	③	④	①	②	③	④
k. Engage students in applications of mathematics in a variety of contexts.	①	②	③	④	①	②	③	④

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2. (continued)

	Importance				Preparation			
	Not Important	Somewhat Important	Fairly Important	Very Important	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
l. Use performance-based assessment.	①	②	③	④	①	②	③	④
m. Use portfolios.	①	②	③	④	①	②	③	④
n. Use informal questioning to assess student understanding.	①	②	③	④	①	②	③	④

3. My school principal: (Darken one oval on each line.)

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
a. Encourages me to select mathematics content and instructional strategies that address individual students' learning.	①	②	③	④	⑤
b. Accepts the noise that comes with an active classroom.	①	②	③	④	⑤
c. Encourages the implementation of current national standards in mathematics education.	①	②	③	④	⑤
d. Encourages innovative instructional practices.	①	②	③	④	⑤
e. Enhances the mathematics program by providing me with needed materials and equipment.	①	②	③	④	⑤
f. Provides time for teachers to meet and share ideas with one another.	①	②	③	④	⑤
g. Encourages me to observe exemplary mathematics teachers.	①	②	③	④	⑤
h. Encourages teachers to make connections across disciplines.	①	②	③	④	⑤
i. Acts as a buffer between teachers and external pressures (e.g., parents).	①	②	③	④	⑤

4. Many teachers feel better prepared to teach some subject areas than others. How well prepared do you feel to teach each of the following subjects at the grade levels you teach, whether or not they are currently included in your curriculum? (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Science	①	②	③	④
b. Mathematics	①	②	③	④
c. Reading/Language Arts	①	②	③	④
d. Social Studies	①	②	③	④

5. Within mathematics, many teachers feel better prepared to teach some topics than others. How well prepared do you feel to teach each of the following topics at the grade levels you teach, whether or not they are currently included in your curriculum? (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Numeration and number theory	①	②	③	④
b. Computation	①	②	③	④
c. Estimation	①	②	③	④
d. Measurement	①	②	③	④
e. Pre-algebra	①	②	③	④
f. Algebra	①	②	③	④
g. Patterns and relationships	①	②	③	④
h. Geometry and spatial sense	①	②	③	④
i. Data collection and analysis	①	②	③	④
j. Probability	①	②	③	④
k. Technology (calculators, computers) in support of mathematics	①	②	③	④

6. Please indicate how well prepared you feel to do each of the following. (Darken one oval on each line.)

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
a. Lead a class of students using investigative strategies.	①	②	③	④
b. Manage a class of students engaged in hands-on/project-based work.	①	②	③	④
c. Help students take responsibility for their own learning.	①	②	③	④
d. Recognize and respond to student diversity.	①	②	③	④
e. Encourage students' interest in mathematics.	①	②	③	④
f. Use strategies that specifically encourage participation of females and minorities in mathematics.	①	②	③	④
g. Involve parents in the mathematics education of their students.	①	②	③	④

7. Please rate the effect of each of the following on your mathematics instruction. (Darken one oval on each line.)

	Inhibits effective instruction		Neutral or mixed		Encourages effective instruction	NA/ Don't Know
a. State and/or district curriculum frameworks.	①	②	③	④	⑤	NA
b. State and/or district testing policies and practices.	①	②	③	④	⑤	NA
c. Quality of available instructional materials.	①	②	③	④	⑤	NA
d. Access to calculators for mathematics instruction.	①	②	③	④	⑤	NA
e. Access to computers for mathematics instruction.	①	②	③	④	⑤	NA
f. Funds for purchasing equipment and supplies for mathematics.	①	②	③	④	⑤	NA
g. System of managing instructional resources at the district or school level.	①	②	③	④	⑤	NA
h. Time available for teachers to plan and prepare lessons.	①	②	③	④	⑤	NA
i. Opportunities for teachers to work with other teachers.	①	②	③	④	⑤	NA
j. Opportunities for teacher professional development.	①	②	③	④	⑤	NA
k. Importance that the school places on mathematics.	①	②	③	④	⑤	NA
l. Consistency of mathematics reform efforts with other school/district reforms.	①	②	③	④	⑤	NA
m. Public attitudes toward reform.	①	②	③	④	⑤	NA

8. How many of your students' parents do each of the following? (Darken one oval on each line.)

	Few or None		About 1/2		Almost All
a. Volunteer to assist with class activities.	①	②	③	④	⑤
b. Donate money or materials for classroom instruction.	①	②	③	④	⑤
c. Attend parent-teacher conferences.	①	②	③	④	⑤
d. Attend school activities such as PTA meetings and Family Mathematics nights.	①	②	③	④	⑤
e. Voice support for the use of an investigative approach to mathematics instruction.	①	②	③	④	⑤
f. Voice support for traditional approaches to mathematics instruction.	①	②	③	④	⑤

B. Your Mathematics Teaching

9. What grade level(s) are you currently teaching? (Darken all ovals that apply.)

K	1	2	3	4	5	6	7	8	9	10	11	12
○	○	○	○	○	○	○	○	○	○	○	○	○

Questions 10-12d ask about your mathematics teaching. If you teach more than one mathematics class, please answer for your first class of the day.

10. About how often do **you** do each of the following in your mathematics instruction? (Darken one oval on each line.)

		Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once or twice a month)	Often (e.g., once or twice a week)	All or almost all mathematics lessons
a.	Introduce content through formal presentations.	①	②	③	④	⑤
b.	Arrange seating to facilitate student discussion.	①	②	③	④	⑤
c.	Use open-ended questions.	①	②	③	④	⑤
d.	Require students to explain their reasoning when giving an answer.	①	②	③	④	⑤
e.	Encourage students to communicate mathematically.	①	②	③	④	⑤
f.	Encourage students to explore alternative methods for solutions.	①	②	③	④	⑤
g.	Encourage students to use multiple representations (e.g., numeric, graphic, geometric, etc.).	①	②	③	④	⑤
h.	Allow students to work at their own pace.	①	②	③	④	⑤
i.	Use assessment to find out what students know before or during a unit.	①	②	③	④	⑤
j.	Embed assessment in regular class activities.	①	②	③	④	⑤
k.	Assign mathematics homework.	①	②	③	④	⑤
l.	Read and comment on the reflections students have written in their notebooks or journals.	①	②	③	④	⑤

11. About how often do **students** in this class take part in each of the following types of activities as part of their mathematics instruction? (Darken one oval on each line.)

		Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once or twice a month)	Often (e.g., once or twice a week)	All or almost all mathematics lessons
a.	Participate in student-led discussions.	①	②	③	④	⑤
b.	Participate in discussions with the teacher to further mathematical understanding.	①	②	③	④	⑤
c.	Work in cooperative learning groups.	①	②	③	④	⑤
d.	Make formal presentations to the class.	①	②	③	④	⑤
e.	Read from a mathematics textbook in class.	①	②	③	④	⑤
f.	Read other (non-textbook) mathematics-related materials in class.	①	②	③	④	⑤
g.	Practice routine computations/algorithms.	①	②	③	④	⑤
h.	Review homework/worksheet assignments.	①	②	③	④	⑤
i.	Use mathematical concepts to interpret and solve word problems.	①	②	③	④	⑤
j.	Work on solving a real-world problem.	①	②	③	④	⑤
k.	Share ideas or solve problems with each other in small groups.	①	②	③	④	⑤
l.	Engage in hands-on mathematical activities.	①	②	③	④	⑤
m.	Play mathematics games.	①	②	③	④	⑤
n.	Follow specific instructions in an activity or investigation.	①	②	③	④	⑤
o.	Design or implement their *own* investigation.	①	②	③	④	⑤
p.	Work on models or simulations.	①	②	③	④	⑤
q.	Work on extended mathematics investigations or projects (a week or more in duration).	①	②	③	④	⑤
r.	Participate in field work.	①	②	③	④	⑤
s.	Record, represent and/or analyze data.	①	②	③	④	⑤
t.	Write a description of a plan, procedure or problem-solving process.	①	②	③	④	⑤
u.	Write reflections in a notebook or journal.	①	②	③	④	⑤

11. (continued)

	Never	Rarely (e.g., a few times a year)	Sometimes (e.g., once or twice a month)	Often (e.g., once or twice a week)	All or almost all mathematics lessons
v. Use calculators or computers for learning or practicing skills.	①	②	③	④	⑤
w. Use calculators or computers to develop conceptual understanding.	①	②	③	④	⑤
x. Use calculators or computers as a tool (e.g., spreadsheets, data analysis).	①	②	③	④	⑤
y. Work on portfolios.	①	②	③	④	⑤
z. Take short-answer tests (e.g., multiple choice, true/false, fill-in-the-blank).	①	②	③	④	⑤
aa. Take tests requiring open-ended responses (e.g., descriptions, justifications of solutions).	①	②	③	④	⑤
bb. Engage in performance tasks for assessment purposes.	①	②	③	④	⑤

12a. Do you teach in a self-contained classroom?

○ Yes ○ No (Skip to Question 13)

12b. How many lessons per week do you typically teach mathematics to this class?

Number of Lessons

0	1	2	3	4	5
○	○	○	○	○	○

12c. Approximately how many minutes is a typical mathematics lesson?

Average Number of Minutes per Lesson

<10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81 or more
○	○	○	○	○	○	○	○	○

12d. In how many of the last five school days did you teach each of the following in this class? (Darken one oval on each line.)

Number of Days

	none	one	two	three	four	five
a. Science	○	○	○	○	○	○
b. Mathematics	○	○	○	○	○	○
c. Reading/Language Arts	○	○	○	○	○	○
d. Social Studies	○	○	○	○	○	○

C. LSC Professional Development

Questions 13-17 refer to the NSF-supported Local Systemic Change (LSC) program. Please refer to the letter accompanying this questionnaire for information about the LSC project activities in your district. If you have not yet participated in LSC professional development, darken this oval ○ and skip to Question 17.

13. To what extent is each of the following true of LSC mathematics-related professional development in your district? (Darken one oval on each line.)

	Not at all				To a great extent
a. I am involved in planning my mathematics-related professional development.	①	②	③	④	⑤
b. I am encouraged to develop an individual professional development plan to address my needs and interests related to mathematics education.	①	②	③	④	⑤
c. I am given time to work with other teachers as part of my professional development.	①	②	③	④	⑤
d. I am given time to reflect on what I've learned and how to apply it to the classroom.	①	②	③	④	⑤
e. I receive support as I try to implement what I've learned.	①	②	③	④	⑤

14. Approximately how many ***hours*** have you spent on professional development in mathematics/mathematics education as part of the LSC project? (Darken one oval.)

- ○ 0
- ○ 1-9
- ○ 10-19
- ○ 20-39
- ○ 40-59
- ○ 60-79
- ○ 80-99
- ○ 100-129
- ○ 130-159
- ○ 160-199
- ○ 200 or greater

15. How would you rate the overall quality of the LSC professional development? (Darken one oval.)

- ○ Very Poor
- ○ Poor
- ○ Fair
- ○ Good
- ○ Very Good
- ○ Excellent

16. To what extent has participation in LSC mathematics-related professional development increased your:

		Not at all				To a great extent
a.	mathematics content knowledge	①	②	③	④	⑤
b.	understanding of how children think about/learn mathematics	①	②	③	④	⑤
c.	ability to implement high-quality mathematics instructional materials	①	②	③	④	⑤

17. Have you been identified as a lead teacher for your district's NSF-sponsored LSC project?

- ○ Yes
- ○ No

D. Teacher Demographic Information

18. Are you:

- ○ Male
- ○ Female

19. Are you:

- ○ African-American (not of Hispanic origin)
- ○ American Indian or Alaskan Native
- ○ Asian or Pacific Islander
- ○ Hispanic
- ○ White (not of Hispanic origin)
- ○ Other

20. How many college mathematics courses have you completed? (Darken one oval.)

- ○ none
- ○ 1 semester
- ○ 2 semesters
- ○ 3 semesters
- ○ 4 semesters
- ○ 5 or more semesters

21. Did your college mathematics coursework include the equivalent of at least one semester of:

(Darken one oval on each line.)		Yes	No
a.	number system concepts	○	○
b.	concepts in algebra	○	○
c.	concepts in geometry	○	○

22. How many years have you taught prior to this school year? (Darken one oval.)

0-2	3-5	6-10	11-20	21 or more
○	○	○	○	○

1998 Local Systemic Change Principal Questionnaire

Form Approval
OMB No: 3145-0161
Expires: Sept. 30, 1998

Instructions: Please use a #2 pencil to complete this questionnaire. Darken ovals completely, but do not stray into adjacent ovals. Be sure to erase completely any stray marks.

A. Instruction

1. Please indicate the extent to which your school is involved in reform in each of the following areas. (Darken one oval on each line.)

	No reforms being discussed	Exploring possibilities	Initial stages of reform	Heavily involved in reform
a. Language Arts	①	②	③	④
b. Mathematics	①	②	③	④
c. Science	①	②	③	④
d. Social Studies/History	①	②	③	④
e. Technology	①	②	③	④
f. Integrating the curriculum across disciplines	①	②	③	④
g. Site-based management	①	②	③	④

2. Please provide your opinion about each of the following statements regarding science and mathematics instruction. (Darken one oval in each section on each line.)

	Science					Mathematics				
	Strongly disagree		No opinion		Strongly agree	Strongly disagree		No opinion		Strongly agree
a. Students generally learn best in classes with students of similar abilities.	①	②	③	④	⑤	①	②	③	④	⑤
b. I am knowledgeable about the current national standards in this content area.	①	②	③	④	⑤	①	②	③	④	⑤
c. I feel well-prepared to support teachers in the implementation of current national standards.	①	②	③	④	⑤	①	②	③	④	⑤
d. I am willing to accept the noise that comes with an active classroom.	①	②	③	④	⑤	①	②	③	④	⑤
e. Encouraging student questions is more important than eliciting correct answers.	①	②	③	④	⑤	①	②	③	④	⑤

3. Please rate each of the following in terms of its importance for effective science and mathematics instruction. (Darken one oval in each section on each line.)

	Science				Mathematics			
	Not Important	Somewhat Important	Fairly Important	Very Important	Not Important	Somewhat Important	Fairly Important	Very Important
a. Provide concrete experience before abstract concepts.	①	②	③	④	①	②	③	④
b. Develop students' conceptual understanding of the subject.	①	②	③	④	①	②	③	④
c. Take students' prior understanding of subject matter into account when planning curriculum and instruction.	①	②	③	④	①	②	③	④
d. Practice computational skills and algorithms.	①	②	③	④	①	②	③	④
e. Make connections to other disciplines.	①	②	③	④	①	②	③	④

PLEASE DO NOT WRITE IN THIS AREA

3. (continued)

	Science				Mathematics			
	Not Important	Somewhat Important	Fairly Important	Very Important	Not Important	Somewhat Important	Fairly Important	Very Important
f. Have students work in cooperative learning groups.	①	②	③	④	①	②	③	④
g. Have students participate in appropriate hands-on activities.	①	②	③	④	①	②	③	④
h. Engage students in inquiry-oriented activities.	①	②	③	④	①	②	③	④
i. Use calculators.	①	②	③	④	①	②	③	④
j. Use computers.	①	②	③	④	①	②	③	④
k. Engage students in applications of subject matter in a variety of contexts.	①	②	③	④	①	②	③	④
l. Use performance-based assessment.	①	②	③	④	①	②	③	④
m. Use portfolios.	①	②	③	④	①	②	③	④
n. Use informal questioning to assess student understanding.	①	②	③	④	①	②	③	④

4. Please rate the effect of each of the following on *science* instruction in your school. (Darken one oval on each line.)

	Inhibits effective instruction		Neutral or mixed		Encourages effective instruction	NA/ Don't Know
a. State and/or district curriculum frameworks.	①	②	③	④	⑤	NA
b. State and/or district testing policies and practices.	①	②	③	④	⑤	NA
c. State, district, and/or school grading policies and practices.	①	②	③	④	⑤	NA
d. Counseling department policies and practices.	①	②	③	④	⑤	NA
e. College placement tests.	①	②	③	④	⑤	NA
f. District/school structures for recognizing and rewarding teachers.	①	②	③	④	⑤	NA
g. Quality of available instructional materials.	①	②	③	④	⑤	NA
h. Access to computers for science instruction.	①	②	③	④	⑤	NA
i. Funds for purchasing equipment and supplies for science.	①	②	③	④	⑤	NA
j. System of managing instructional resources at the district or school level.	①	②	③	④	⑤	NA
k. Time available for teachers to plan and prepare lessons.	①	②	③	④	⑤	NA
l. Opportunities for teachers to work with other teachers.	①	②	③	④	⑤	NA
m. Opportunities for teacher professional development.	①	②	③	④	⑤	NA
n. Importance that the school places on science.	①	②	③	④	⑤	NA
o. Consistency of science reform efforts with other school/district reforms.	①	②	③	④	⑤	NA
p. Public attitudes toward reform.	①	②	③	④	⑤	NA

5. Please rate the effect of each of the following on *mathematics* instruction in your school.
(Darken one oval on each line.)

	Inhibits effective instruction		Neutral or mixed		Encourages effective instruction	NA/ Don't Know
a. State and/or district curriculum frameworks.	①	②	③	④	⑤	NA
b. State and/or district testing policies and practices.	①	②	③	④	⑤	NA
c. State, district and/or school grading policies and practices.	①	②	③	④	⑤	NA
d. Counseling department policies and practices.	①	②	③	④	⑤	NA
e. College placement tests.	①	②	③	④	⑤	NA
f. District/school structures for recognizing and rewarding teachers.	①	②	③	④	⑤	NA
g. Quality of available instructional materials.	①	②	③	④	⑤	NA
h. Access to calculators for mathematics instruction.	①	②	③	④	⑤	NA
i. Access to computers for mathematics instruction.	①	②	③	④	⑤	NA
j. Funds for purchasing equipment and supplies for mathematics.	①	②	③	④	⑤	NA
k. System of managing instructional resources at the district or school level.	①	②	③	④	⑤	NA
l. Time available for teachers to plan and prepare lessons.	①	②	③	④	⑤	NA
m. Opportunities for teachers to work with other teachers.	①	②	③	④	⑤	NA
n. Opportunities for teacher professional development.	①	②	③	④	⑤	NA
o. Importance that the school places on mathematics.	①	②	③	④	⑤	NA
p. Consistency of mathematics reform efforts with other school/district reforms.	①	②	③	④	⑤	NA
q. Public attitudes toward reform.	①	②	③	④	⑤	NA

6. To what extent:
(Darken one oval on each line.)

	Not at all				To a great extent	Don't know
a. Are you familiar with the LSC project in your district?	①	②	③	④	⑤	DK
b. Have you been involved in LSC project activities?	①	②	③	④	⑤	DK
c. Have teachers in your school been involved in LSC project activities?	①	②	③	④	⑤	DK
d. Are teachers in your school using the LSC-specified instructional materials with their students?	①	②	③	④	⑤	DK
e. Are teachers in your school using the LSC-advocated instructional strategies with their students?	①	②	③	④	⑤	DK

7. How would you describe your school's progress in moving toward excellence in science and mathematics education?
(Darken one oval on each line.)

	Quite far from ideal		Beginning to improve		Well along in improving		Approaching ideal
a. Science program	①	②	③	④	⑤	⑥	⑦
b. Mathematics program	①	②	③	④	⑤	⑥	⑦

B. Principal Information

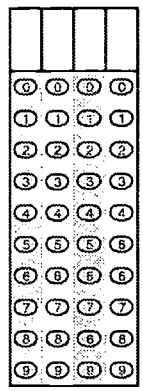
8. Including this year, how many years have you been:
(Darken one oval on each line.)

	1	2	3	4	5	6-10	11-20	More than 20
a. A principal?	①	②	③	④	⑤	⑥	⑦	⑧
b. The principal at this school?	①	②	③	④	⑤	⑥	⑦	⑧
c. A principal in this school district?	①	②	③	④	⑤	⑥	⑦	⑧

~Place Label Here~

C. School Characteristics

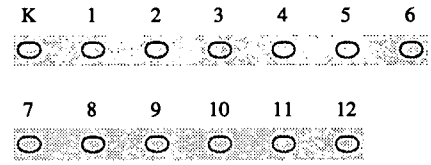
9. How many students attend your school? (Please enter your response as a four digit number and then darken the appropriate oval in each column. For example, enter 850 students as 0850.)



10. In what type of community is this school located? (Darken one oval

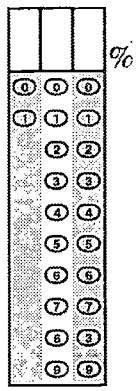
- Rural
- Town or Small City
- Suburban
- Urban

11. This school includes the following grades: (Darken all that apply.)

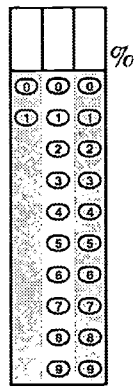


12. Approximately what percentage of the students attending this school are: (Please enter each as a three-digit number and then darken the appropriate oval in each column. For example, enter 25 percent as 025, enter less than 1/2 percent as 000.)

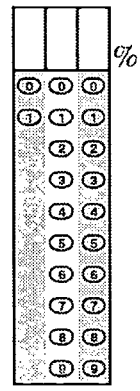
a. American Indian or Alaskan Native?



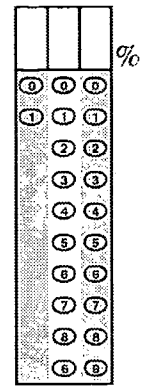
b. African-American?



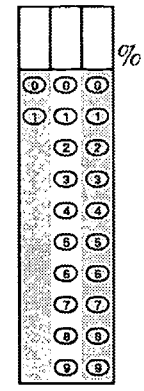
c. Asian or Pacific Islander?



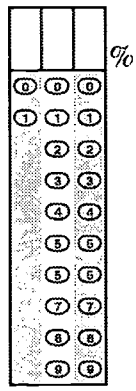
d. Hispanic, regardless of race?



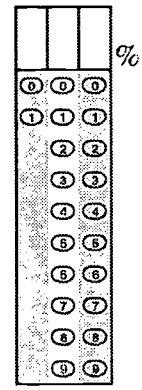
e. White (not of Hispanic origin)?



13. What is the estimated percentage of students in this school with limited English proficiency?



14. What percentage of the students in this school are eligible for free or reduced price lunches that are paid for with public funds?



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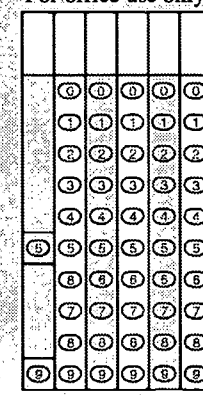

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PLEASE DO NOT WRITE IN THIS AREA

1997–98 Local Systemic Change
Pre-Classroom Observation Interview

After you have expressed appreciation to the teacher for allowing you to observe the class, ask the following question:

1. What has this class been doing in mathematics/science recently?

   PROBES: What unit are you working on?
   What instructional materials are you using[1]?

2. What do you anticipate doing in your mathematics/science class on the day I will be observing?

   PROBE: What do you hope students will learn as a result of the work you have planned?

3. What is the next step for this class?

4. Is there anything in particular that I should know about the group of students that I will be observing?

[1] Note that the evaluator will need to be thoroughly conversant with the instructional materials designated for use by the LSC in order to complete the observation ratings.

NOTE: This form is included for information purposes only. Evaluators will need to complete the form on the Web or request scannable forms from HRI.

1997–98 Local Systemic Change *REVISED* Classroom Observation Protocol[1]

BACKGROUND INFORMATION

Project _____

LSC ID[2] _____

___ Random Sample ___ Backup Sample

___ Other, specify _____

Subject Observed[3] _____

Grade Level _____

Date of Observation _____

Time of Observation:

Start _____ End _____

Observer _____

Observer's Role in Project:

___ Project Evaluator ___ Local Observer

___ Lead

___ Other

SECTION ONE: CONTEXTUAL BACKGROUND AND ACTIVITIES

In this section, please fill in the circles that best describe the class. ***For each item, be sure to fill in all responses that apply.***

I. Classroom Demographics

A. What is the total number of students in the class at the time of the observation?

- O 15 or fewer
- O 16–20
- O 21–25
- O 26–30
- O 31 or more

B. What is the approximate percentage of white (not Hispanic origin) students in this class?

- O 0–10 percent
- O 11–25 percent
- O 26–50 percent
- O 51–75 percent
- O 76–100 percent

C. Indicate the *teacher's*:

1. Gender
   - O Male O Female
2. Race/Ethnicity
   - O African-American (not Hispanic origin)
   - O American Indian or Alaskan Native
   - O Asian or Pacific Islander
   - O Hispanic
   - O White (not Hispanic origin)
   - O Other

D. If applicable, indicate the *teacher aide's*:

1. Gender
   - O Male O Female
2. Race/Ethnicity
   - O African-American (not Hispanic origin)
   - O American Indian or Alaskan Native
   - O Asian or Pacific Islander
   - O Hispanic
   - O White (not Hispanic origin)
   - O Other

---

[1] Be sure you have read the "1997–98 Local Systemic Change Classroom Observations: Guidelines for Evaluators" and have completed the "Pre-Classroom Observations Interview" before observing the class.

[2] Use the LSC ID number as indicated in the Classroom Observation Sample provided by HRI.

[3] In mathematics/science projects observe the subject for which the teacher was sampled.

II. Classroom Context

A. Rate the adequacy of the physical environment.

1. Classroom resources:

O	O	O	O	O
1	2	3	4	5
Sparsely equipped				Rich in resources

2. Classroom Space:

O	O	O	O	O
1	2	3	4	5
Crowded				Adequate space

3. Room arrangement:

O	O	O	O	O
1	2	3	4	5
Inhibited interactions among students				Facilitated interactions among students

B. In a few sentences, describe the lesson you observed. Include where this lesson fits in the overall unit of study.

III. Purposes of Lesson

A. Indicate the *major*[4] *content area(s)* of this lesson or activity.

- O 1. Numeration and number theory
- O 2. Computation
- O 3. Estimation
- O 4. Measurement
- O 5. Patterns and relationships
- O 6. Pre-algebra
- O 7. Algebra
- O 8. Geometry and spatial sense
- O 9. Functions (including trigonometric functions) and pre-calculus concepts
- O 10. Data collection and analysis
- O 11. Probability
- O 12. Statistics (e.g., hypothesis tests, curve-fitting, and regression)
- O 13. Topics from discrete mathematics (e.g., combinatorics, graph theory, recursion)
- O 14. Mathematical structures (e.g., vector spaces, groups, rings, fields)
- O 15. Calculus
- O 16. Life Science
- O 17. Physical science
- O 18. Earth/space sciences
  - O a. Astronomy
  - O b. Oceanography
  - O c. Geology
  - O d. Meteorology
  - O e. Environmental science
- O 19. Engineering and design principles
- O 20. History of mathematics/science
- O 21. None of the above (please explain)

[4] "Major" means was used or addressed for a substantial portion of the lesson; if you were describing the lesson to someone, this feature would help characterize it.

B. Indicate the *major*[5] *intended purpose(s)* of this lesson or activity based on the pre- and/or post-observation interviews with the teacher.

- O 1. Identifying prior student knowledge
- O 2. Introducing new concepts
- O 3. Developing conceptual understanding
- O 4. Reviewing mathematics/science concepts
- O 5. Developing problem-solving skills
- O 6. Learning mathematics/science processes, algorithms, or procedures
- O 7. Learning vocabulary/specific facts
- O 8. Practicing computation for mastery
- O 9. Developing appreciation for core ideas in mathematics/science
- O 10. Developing students' awareness of contributions of scientists/mathematicians of diverse backgrounds
- O 11. Assessing student understanding

IV. Instructional Materials

A. Is this lesson based on commercially produced instructional materials?

O Yes O No, SKIP to Part V below

B. Are the instructional materials among those designated for use by this LSC?

O Yes O No, SKIP to Part V below

C. Indicate the *single* set of LSC-designated instructional materials intended to form the basis of this lesson (e.g., FOSS; Insights; STC; Investigations in Number, Data, and Space; Connected Math; IMP), based on the information provided in the pre-observation interview.

Please specify.

_____

D. How closely did the lesson adhere to the instructions provided in the teacher's manual?

O Exactly, SKIP to Part V below
O Almost totally O Mostly O Somewhat O A little O Hardly at all

E. How did the adaptations affect the quality of the lesson?

O Helped a lot O Helped a little O Neutral O Hurt a little O Hurt a lot

V. Classroom Instruction

A. Indicate the *major*[5] *way(s)* in which student activities were structured.

O As a whole group O As small groups O As pairs O As individuals

B. Indicate the *major*[5] *way(s)* in which students engaged in class activities.

O Entire class was engaged in the same activities at the same time.
O Groups of students were engaged in different activities at the same time (e.g., centers).

[5] "Major" means was used or addressed for a substantial portion of the lesson; if you were describing the lesson to someone, this feature would help characterize it.

C. **Indicate the *major*[6] *activities* of students in this lesson.** When choosing an "umbrella" category, be sure to indicate subcategories that apply as well. (For example, if you mark "listened to a presentation," indicate by whom.)

- O 1. Listened to a presentation:
  - O a. By teacher (would include: demonstration, lectures, media presentations, extensive procedural instructions)
  - O b. By student (would include informal, as well as formal, presentations of their work)
  - O c. By guest speaker/"expert" serving as a resource

- O 2. Engaged in discussions/seminars:
  - O a. Whole group
  - O b. Small groups/pairs

- O 3. Engaged in problem solving/investigation:
  - O a. Worked with manipulatives
  - O b. Played a game to build or review knowledge/skills
  - O c. Followed specific instructions in an investigation
  - O d. Had some latitude in designing an investigation
  - O e. Recorded, represented and/or analyzed data
  - O f. Recognized patterns, cycles or trends
  - O g. Evaluated the validity of arguments or claims
  - O h. Provided an informal justification or formal proof

- O 4. Engaged in reading/reflection/written communication about mathematics or science:
  - O a. Read about mathematics/science
  - O b. Answered textbook/worksheet questions
  - O c. Reflected on readings, activities, or problems individually or in groups
  - O d. Prepared a written report
  - O e. Wrote a description of a plan, procedure, or problem-solving process
  - O f. Wrote reflections in a notebook or journal

- O 5. Used technology/audio-visual resources:
  - O a. To develop conceptual understanding
  - O b. To learn or practice a skill
  - O c. To collect data (e.g., probeware)
  - O d. As an analytic tool (e.g., spreadsheets or data analysis)
  - O e. As a presentation tool
  - O f. For word processing or as a communications tool (e.g., e-mail, Internet, Web)

- O 6. Other activities
  - O a. Arts and crafts activity
  - O b. Listened to a story
  - O c. Wrote a poem or story
  - O d. Other (Please specify.) _____

[6] "Major" means was used or addressed for a substantial portion of the lesson; if you were describing the lesson to someone, this feature would help characterize it.

D. Comments

Please provide any additional information you consider necessary to capture the activities or context of this lesson. Include comments on any feature of the class that is so salient that you need to get it "on the table" right away to help explain your ratings; for example, the class was interrupted by a fire drill, the kids were excited about an upcoming school event, or the teacher's tone was so warm (or so hostile) that it was an overwhelmingly important feature of the lesson.

SECTION TWO: RATINGS

In Section One of this form, you documented what occurred in the lesson. In this section, you are asked to rate each of a number of key indicators in four different categories, from 1 (not at all) to 5 (to a great extent). You may list any additional indicators you consider important in capturing the essence of this lesson and rate these as well. Use your "Ratings of Key Indicators" (Part A) to inform your "Synthesis Ratings" (Part B). It is important to indicate in "Supporting Evidence for Synthesis Ratings" (Part C) what factors were most influential in determining your synthesis ratings and to give specific examples or quotes to illustrate those factors.

Note that any one lesson is not likely to provide evidence for every single indicator; use 6, "Don't know" when there is not enough evidence for you to make a judgment. Use 7, "N/A" (Not Applicable) when you consider the indicator inappropriate given the purpose and context of the lesson. Section Two concludes with ratings of the likely impact of instruction, and a capsule description of the lesson.

I. Design

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. The design of the lesson incorporated tasks, roles, and interactions consistent with investigative mathematics/science.	1	2	3	4	5	6	7
2. The design of the session reflected careful planning and organization.	1	2	3	4	5	6	7
3. The instructional strategies and activities used in this lesson reflected attention to students' experience, preparedness, and/or learning styles.	1	2	3	4	5	6	7
4. The resources available in this lesson contributed to accomplishing the purposes of the instruction.	1	2	3	4	5	6	7
5. The instructional strategies and activities reflected attention to issues of access, equity, and diversity for students (e.g., use of "wait time," cooperative learning, language-appropriate strategies/materials).	1	2	3	4	5	6	7
6. The design of the lesson encouraged a collaborative approach to learning.	1	2	3	4	5	6	7
7. Adequate time and structure were provided for reflection.	1	2	3	4	5	6	7
8. Adequate time and structure were provided for wrap-up and closure.	1	2	3	4	5	6	7
9. Formal assessments of students were consistent with investigative mathematics/science.	1	2	3	4	5	6	7
10. Design for future instruction takes into account what transpired in the lesson.	1	2	3	4	5	6	7
11. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Design of the lesson not at all reflective of best practice in mathematics/science education				Design of the lesson extremely reflective of best practice in mathematics/science education

C. Supporting Evidence for Synthesis Rating

II. Implementation

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. The instruction was consistent with the underlying approach of the instructional materials designated for use by the LSC.	1	2	3	4	5	6	7
2. The instructional strategies were consistent with investigative mathematics/science.	1	2	3	4	5	6	7
3. The teacher appeared confident in his/her ability to teach mathematics/science.	1	2	3	4	5	6	7
4. The teacher's classroom management style/strategies enhanced the quality of the lesson.	1	2	3	4	5	6	7
5. The pace of the lesson was appropriate for the developmental levels/needs of the students and the purposes of the lesson.	1	2	3	4	5	6	7
6. The teacher took into account prior knowledge of students.	1	2	3	4	5	6	7
7. The teacher's questioning strategies were likely to enhance the development of student conceptual understanding/problem solving (e.g., emphasized higher order questions, appropriately used "wait time," identified prior conceptions and misconceptions).	1	2	3	4	5	6	7
8. The lesson was modified as needed based on teacher questioning or other student assessments.	1	2	3	4	5	6	7
9. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Implementation of the lesson not at all reflective of best practice in mathematics/science education				Implementation of the lesson extremely reflective of best practice in mathematics/science education

C. Supporting Evidence for Synthesis Rating

III. Mathematics/Science Content

A. Ratings of Key Indicators	Not at all				To a great extent	Don't know	N/A
1. The mathematics/science content was significant and worthwhile.	1	2	3	4	5	6	7
2. The mathematics/science content was appropriate for the developmental level of the students in this class.	1	2	3	4	5	6	7
3. Students were intellectually engaged with important ideas relevant to the focus of the lesson.	1	2	3	4	5	6	7
4. Teacher-presented information was accurate.	1	2	3	4	5	6	7
5. The teacher displayed an understanding of mathematics/science concepts (e.g., in his/her dialogue with students).	1	2	3	4	5	6	7
6. Mathematics/science was portrayed as a dynamic body of knowledge continually enriched by conjecture, investigation analysis, and/or proof/justification.	1	2	3	4	5	6	7
7. Elements of mathematical/science abstraction (e.g., symbolic representations, theory building) were included when it was important to do so.	1	2	3	4	5	6	7
8. Appropriate connections were made to other areas of mathematics/ science, to other disciplines, and/or to real-world contexts.	1	2	3	4	5	6	7
9. The degree of closure or resolution of conceptual understanding was appropriate for the developmental levels/needs of the students and the purposes of the lesson.	1	2	3	4	5	6	7
10. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Mathematics/science content of lesson not at all reflective of current standards for mathematics/science education				Mathematics/science content of lesson extremely reflective of current standards for mathematics/science education

C. Supporting Evidence for Synthesis Rating

IV. Classroom Culture

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Active participation of all was encouraged and valued.	1	2	3	4	5	6	7
2. There was a climate of respect for students' ideas, questions, and contributions.	1	2	3	4	5	6	7
3. Interactions reflected collaborative working relationships among students (e.g., students worked together, talked with each other about the lesson).	1	2	3	4	5	6	7
4. Interactions reflected collaborative working relationships between teacher and students.	1	2	3	4	5	6	7
5. The teacher's language and behavior clearly demonstrated sensitivity to issues of gender, race/ethnicity, special needs, Limited English Proficiency, culture, and/or socio-economic status.[7]	1	2	3	4	5	6	7
6. Opportunities were taken to recognize and challenge stereotypes and biases that became evident during the lesson.	1	2	3	4	5	6	7
7. The climate of the lesson encouraged students to generate ideas, questions, conjectures, and/or propositions.	1	2	3	4	5	6	7
8. Intellectual rigor, constructive criticism, and the challenging of ideas were valued.	1	2	3	4	5	6	7
9. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Classroom culture interferes with student learning				Classroom culture facilitates the learning of all students

C. Supporting Evidence for Synthesis Rating

[7] Use 1, "Not at all," when you have considerable evidence of insensitivity or inequitable behavior; 3, when there are no examples either way; and 5, "To a great extent," when there is considerable evidence of proactive efforts to achieve equity.

V. Overall Ratings of the Lesson

A. Likely Impact of Instruction on Students' Understanding of Mathematics/Science

While the impact of a single lesson may well be limited in scope, it is important to judge whether the lesson is helping move students in the desired direction. For this series of ratings, consider all available information (i.e., your previous ratings of design, implementation, content, and culture, and the pre- and post-observation interviews with the teacher) as you assess the likely impact of this lesson. Feel free to elaborate on ratings with comments in the space provided.

Select the response that best describes your overall assessment of the *likely effect* of this lesson in each of the following areas.

	Negative effect		Mixed or Neutral effect		Positive effect	Don't know	N/A
1. Students' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation.	O	O	O	O	O	O	O
2. Students' understanding of important mathematics/science concepts.	O	O	O	O	O	O	O
3. Students' capacity to carry out their own inquiries.	O	O	O	O	O	O	O
4. Students' ability to apply or generalize skills and concepts to other areas of mathematics/science, other disciplines, and/or real-life situations.	O	O	O	O	O	O	O
5. Students' self-confidence in doing mathematics/science.	O	O	O	O	O	O	O
6. Students' interest in and/or appreciation for the discipline.	O	O	O	O	O	O	O

Comments (optional):

B. Capsule Description of the Quality of the Lesson

In this final rating of the lesson, consider all available information about the lesson, its context and purpose, and your own judgment of the relative importance of the ratings you have made. Select the capsule description that best characterizes the lesson you observed. Keep in mind that this rating is *not* intended to be an average of all the previous ratings, but should encapsulate your overall assessment of the quality and likely impact of the lesson. Please provide a brief rationale for your final capsule description of the lesson in the space provided.

O **Level 1: Ineffective Instruction**
There is little or no evidence of student thinking or engagement with important ideas of mathematics/science. Instruction is *unlikely* to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science. Lesson was characterized by either (select one below):

- O **Passive "Learning"**
  Instruction is pedantic and uninspiring. Students are passive recipients of information from the teacher or textbook; material is presented in a way that is inaccessible to many of the students.

- O **Activity for Activity's Sake**
  Students are involved in hands-on activities or other individual or group work, but it appears to be activity for activity's sake. Lesson lacks a clear sense of purpose and/or a clear link to conceptual development.

O **Level 2: Elements of Effective Instruction**
Instruction contains some elements of effective practice, but there are *substantial problems* in the design, implementation, content, and/or appropriateness for many students in the class. For example, the content may lack importance and/or appropriateness; instruction may not successfully address the difficulties that many students are experiencing, etc. Overall, the lesson is *quite limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science.

O **Level 3: Beginning Stages of Effective Instruction** (Select one below.)
O Low 3 O Solid 3 O High 3
Instruction is purposeful and characterized by quite a few elements of effective practice. Students are, at times, engaged in meaningful work, but there are *some weaknesses* in the design, implementation, or content of instruction. For example, the teacher may short-circuit a planned exploration by telling students what they "should have found"; instruction may not adequately address the needs of a number of students; or the classroom culture may limit the accessibility or effectiveness of the lesson. Overall, the lesson is *somewhat limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science.

O **Level 4: Accomplished, Effective Instruction**
Instruction is purposeful and engaging for most students. Students actively participate in meaningful work (e.g., investigations, teacher presentations, discussions with each other or the teacher, reading). The lesson is well-designed and the teacher implements it well, but adaptation of content or pedagogy in response to student needs and interests is limited. Instruction is *quite likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" mathematics/science.

O **Level 5: Exemplary Instruction**
Instruction is purposeful and all students are highly engaged most or all of the time in meaningful work (e.g., investigation, teacher presentations, discussions with each other or the teacher, reading). The lesson is well-designed and artfully implemented, with flexibility and responsiveness to students' needs and interests. Instruction is *highly likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" mathematics/science.

Please provide your rationale for the capsule rating:

1997–98 Local Systemic Change
Post-Classroom Observation Interview

After you have expressed appreciation to the teacher for allowing you to observe the class, ask the following questions:

1. Were there any ways in which the lesson was different from what you had planned?

2. What did this lesson tell you about what your students are learning and still need to learn in mathematics/science?

   PROBE: How do you plan to further assess the students' learning?

3. What challenges have you faced in encouraging your students to be actively engaged in this mathematics/science class?

   PROBE: How have you approached these challenges?

4. What is the next step for this class?

NOTE: This form is included for information purposes only. Evaluators will need to complete the form on the Web or request scannable forms from HRI.

1998–99 Local Systemic Change Professional Development Observation Protocol[1]

BACKGROUND INFORMATION

Project _____

Location _____

Observer _____

Date of Observation _____

If you are submitting two professional development observations for this date, indicate whether this was the first or second session observed. O 1st O 2nd

Approximate Duration of Observation[2]:
O 1 hour O 3 hours
O 2 hours O half day

Observer's Role in Project: O Project Evaluator O Local Observer
O Lead
O Other

Subject Targeted by session O Mathematics O Science O Both Mathematics and Science

SECTION ONE: CONTEXTUAL BACKGROUND AND ACTIVITIES

In this section, please fill in the circles that best describe the session. ***For each item, be sure to fill in all responses that apply.***

I. Session Demographics

A. What is the total number of participants attending this session?

O 1–5 O 6–10 O 11–20 O 21–50 O 51–100 O More than 100

B. Please describe the targeted subject(s)/grade level(s)/audience for this professional development session.

1. This session was intended to improve the teaching of: (select all that apply)
   - O Elementary science
   - O Elementary mathematics
   - O Middle grades science
   - O Middle grades mathematics
   - O High school science
   - O High school mathematics

2. Participants were:
   - O Lead teachers for the LSC projects
   - O Other (non-lead) teachers
   - O Administrators
   - O Other (Please specify.) _____

[1] Be sure you have read the "1998–99 Local Systemic Change Professional Development Observations: Guidelines for Evaluators" and have completed the "Pre-Observation Interview with Professional Development Facilitator" before observing the session.

[2] The observation recorded on this form should be no less than one hour and no more than half a day.

C. Please describe the major presenters/facilitators[3] for this particular one-hour to half-day professional development session.

1. Indicate the number of presenters/facilitators in each gender and race/ethnicity category.

	African-American (not Hispanic-origin)	American Indian or Alaskan Native	Asian or Pacific Islander	Hispanic	White (not Hispanic origin)	Other
Male						
Female						

2. Indicate the number of presenters/facilitators for this particular session with each affiliation.

Regular Full-Time or Part-Time Classroom Teachers	Teachers on Special Assignment[4]	District Mathematics/ Science Supervisor	Other District Personnel	University Mathematics/ Science Faculty	University Mathematics/ Science Education Faculty	Business Industry Mathematicians/ Scientists	Other Non-District Personnel

II. Session Context

In a few sentences, describe the session you observed. Include: (a) whether the observation covered a partial or complete session, (b) whether there were multiple break-out sessions, and (c) where this session fits in the project's sequence of professional development for those in attendance.

III. Session Focus

A. Indicate the *primary intended purpose(s)* of this professional development session based on the information provided by the project staff.

O 1. Increasing mathematics/science content knowledge of teachers and/or teacher leaders. (*Be sure to complete Category III: Mathematics/Science Content and Category VII.A: Likely Impact on Participants' Capacity to Provide High-Quality Mathematics/Science Education, in Section Two of the protocol.*)

O 2. *Explicit* attention to classroom pedagogy. (*Be sure to complete Category IV: Exploring Pedagogy and Category VII.A: Likely Impact on Participants' Capacity to Provide High-Quality Mathematics/Science Education, in Section Two of the protocol.*)

- O a. Creating a vision of effective mathematics/science instruction
- O b. Understanding student thinking/learning about mathematics/science content
- O c. Learning how to use specific instructional materials in the classroom
- O d. Learning how to use technology in the classroom.
- O e. Learning pedagogical/classroom management strategies
- O f. Considering issues of access, equity, and diversity
- O g. Designing or scoring student assessments
- O h. Considering issues of scope and sequence (e.g., K-12 curricular frameworks)

O 3. *Explicit* attention to strategies/issues/roles of teacher leaders. (*Be sure to complete Category V: Leadership Content and Category VII.B: Likely Impact on Participants' Leadership Capacity, in Section Two of the protocol.*)

O 4. Other major purposes:

- O a. Orientation to the project
- O b. Assessing participants' knowledge/skills
- O c. Building professional networks among educators
- O d. Promoting/exploring reflective practice
- O e. Developing the capacity of participants to use technology
- O f. Involving administrators and/or other school/district personnel in the reform process

[3] In some instances this may not be appropriate, e.g., a session in which a group of teachers meets after school to discuss their action research projects may have no presenters or facilitators. In these instances, please leave the presenters/facilitators cells blank.

[4] Defined as teachers released full-time from classroom responsibilities to work on assignments such as the LSC project.

B. Indicate the *major*[5] *mathematics/science content area(s)* addressed in this professional development session, whether increasing content knowledge was a stated purpose or the mathematics/science content was simply a vehicle for achieving other purposes.

- O 1. Numeration and number theory
- O 2. Computation
- O 3. Estimation
- O 4. Measurement
- O 5. Patterns and relationships
- O 6. Pre-algebra
- O 7. Algebra
- O 8. Geometry and spatial sense
- O 9. Functions (including trigonometric functions) and pre-calculus concepts
- O 10. Data collection and analysis
- O 11. Probability
- O 12. Statistics (e.g., hypothesis tests, curve-fitting, and regression)
- O 13. Topics from discrete mathematics (e.g., combinatorics, graph theory, recursion)
- O 14. Mathematical structures (e.g., vector spaces, groups, rings, fields)
- O 15. Calculus
- O 16. Life Science (Please specify.) _____
- O 17. Physical science (Please specify.) _____
- O 18. Earth/space sciences
  - O a. Astronomy
  - O b. Oceanography
  - O c. Geology
  - O d. Meteorology
  - O e. Environmental science
- O 19. Engineering and design principles
- O 20. History of mathematics/science

☐ **Mathematics/science concepts were not included as either an explicit focus or a vehicle for achieving other professional development purposes**

IV. Professional Development Activities

A. Were any of the instructional materials intended for classroom use as part of the LSC (e.g., FOSS; Insights; STC; Investigations in Number, Data, and Space; Connected Math; IMP; SEPUP) a focus of the professional development session?

- O No
- O Yes Please specify. _____

B. Indicate the *major*[5] *activities* of participants in this session. When choosing an "umbrella" category, be sure to indicate subcategories that apply as well. For example, if you mark "formal presentations," indicate by whom.

- O 1. Listened to a formal presentation by:
  - O a. Presenter/facilitator
  - O b. Participant(s)
- O 2. Engaged in discussions/seminars/reporting out structured as:
  - O a. Whole group led by presenter/facilitator
  - O b. Whole group led by participant(s)
  - O c. Small groups/pairs
- O 3. Engaged in problem solving/investigation
- O 4. Read about disciplinary content, pedagogy, or reform issues
- O 5. Wrote about disciplinary content, pedagogy, or reform issues

C. Comments

Please provide any additional information you consider necessary to capture the activities or context of this professional development session. Include comments on any feature of the session that is so salient that you need to get it "on the table" right away to help explain your ratings.

[5] "Major" means was used or addressed for a substantial portion of the session; if you were describing the session to someone, this feature would help characterize it.

SECTION TWO: RATINGS

In Section One of this form, you documented what occurred in the session. In this section, you are asked to use that information, as well as any other pertinent observations, to rate each of a number of key indicators in six different categories, from 1 (not at all) to 5 (to a great extent).

Note that any one session is not likely to provide evidence for every single indicator; use 6, "Don't know" when there is not enough evidence for you to make a judgment. Use 7, "N/A" (Not Applicable) when you consider the indicator inappropriate given the purpose and context of the session. For example, a session that focuses on engaging teachers in mathematics/science inquiry may choose not to address classroom applications. In that case, key indicator #7 for Design, "The design of the session provided opportunities for teachers to consider classroom applications of resources, strategies, and techniques," would be rated "N/A," rather than "not at all."

Similarly, there may be entire rating categories that are not applicable to a particular session. For example, categories III, IV, and V (Content) and Overall Ratings VIIA (Impact on Participants' Capacity to Provide High Quality Mathematics/Science Education) and VIIB (Impact on Participants' Leadership Capacity) each have a box to check when the entire rating category is judged to be inappropriate for the session[6]. Categories I (Design), II (Implementation), and VI (Culture of the Professional Development Session) are ones in which specific indicators may be "not applicable," but the overall category should routinely be rated for any observation.

Note that you may list any additional indicators you consider important in capturing the essence of this session and rate these as well.

Use your "Ratings of Key Indicators" (Part A) to inform your "Synthesis Ratings" (Part B). It is important to indicate in "Supporting Evidence for Synthesis Ratings" (Part C) what factors were most influential in determining your synthesis ratings and to give specific examples or quotes to illustrate those factors. Section Two concludes with ratings of the likely impact of professional development, and a capsule description of the session.

[6] In most cases, the categories you rate will be consistent with the purposes marked in Section One. Part III.A.1 through 3.

I. Design

A. Ratings of Key Indicators

		Not at all				To a great extent	Don't know	N/A
1.	The design of the session incorporated tasks, roles, and interactions consistent with a spirit of investigation.	1	2	3	4	5	6	7
2.	The instructional strategies and activities used in this session reflected attention to participants' experience, preparedness, and/or learning styles.	1	2	3	4	5	6	7
3.	The session effectively built on participants' knowledge of content, teaching, learning, and/or the reform process.	1	2	3	4	5	6	7
4.	The strategies in this session were appropriate for accomplishing the purposes of the LSC professional development.	1	2	3	4	5	6	7
5.	The design of the session reflected careful planning and organization.	1	2	3	4	5	6	7
6.	The design of the session encouraged a collaborative approach to learning.	1	2	3	4	5	6	7
7.	The design of the session provided opportunities for teachers to consider classroom applications of resources, strategies, and techniques.	1	2	3	4	5	6	7
8.	Adequate time and structure were provided for reflection.	1	2	3	4	5	6	7
9.	Adequate time and structure were provided for participants to share experiences and insights.	1	2	3	4	5	6	7
10.	Adequate time and structure were provided for wrap-up and closure.	1	2	3	4	5	6	7
11.	_____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Design of the session not at all reflective of best practice for professional development.				Design of the session extremely reflective of best practice for professional development.

C. Supporting Evidence for Synthesis Rating

II. Implementation

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. The session effectively incorporated instructional strategies that were appropriate for the purposes of the professional development session.	1	2	3	4	5	6	7
2. The session effectively modeled questioning strategies that are likely to enhance the development of conceptual understanding (e.g., emphasis on higher-order questions, appropriate use of "wait time," identifying prior conceptions and misconceptions.)	1	2	3	4	5	6	7
3. The pace of the session was appropriate for the purposes of the professional development and the needs of adult learners.	1	2	3	4	5	6	7
4. The session modeled effective assessment strategies.	1	2	3	4	5	6	7
5. The facilitator(s)' background, experience, and/or expertise enhanced the quality of the session.	1	2	3	4	5	6	7
6. The facilitator(s)' management style/strategies enhanced the quality of the session.	1	2	3	4	5	6	7
7. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Implementation of the session not at all reflective of best practice for professional development.				Implementation of the session extremely reflective of best practice for professional development

C. Supporting Evidence for Synthesis Rating

III. Mathematics/Science Content

Complete this category if: a) increasing mathematics/science content knowledge was a key purpose of the session; b) mathematics/science content was a vehicle for accomplishing other professional development purposes; or c) inadequate coverage in this area acted as a barrier to accomplishing other stated purposes of the session. If none of these apply, check here ☐ and skip to category IV.

A. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Mathematics/science content was appropriate for the purposes of the professional development session and the backgrounds of the participants.	1	2	3	4	5	6	7
2. Mathematics/science content was sound and appropriately presented/explored.	1	2	3	4	5	6	7
3. Participants were intellectually engaged with important ideas relevant to the focus of the session.	1	2	3	4	5	6	7
4. Facilitator(s) displayed an understanding of mathematics/science concepts (e.g., in their dialogue with participants).	1	2	3	4	5	6	7
5. Mathematics/science was portrayed as a dynamic body of knowledge continually enriched by conjecture, investigation, analysis, and/or proof/justification.	1	2	3	4	5	6	7
6. Depth and breadth of attention to mathematics/science content was appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
7. Elements of mathematical/scientific abstraction (e.g., symbolic representations, theory building) were included when it was important to do so.	1	2	3	4	5	6	7
8. Appropriate connections were made to other areas of mathematics/ science, to other disciplines, and/or to real-world contexts.	1	2	3	4	5	6	7
9. Degree of closure or resolution of mathematics/science conceptual understanding was appropriate for the purposes of the session and the needs of adult learners.	1	2	3	4	5	6	7
10. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Mathematics/science content of session not at all reflective of current standards for mathematics/science education				Mathematics/science content of session extremely reflective of current standards for mathematics/science education

C. Supporting Evidence for Synthesis Rating

IV. Exploring Pedagogy

Complete this category if: a) exploring classroom practice was a key purpose of the session; or b) lack of/inadequate coverage in this area acted as a barrier to accomplishing other stated purposes of the session. If neither of these apply, check here ☐ and skip to category V.

A. Ratings of Key Indicators	Not at all				To a great extent	Don't know	N/A
1. Depth and breadth of attention to student thinking/learning were appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
2. Depth and breadth of attention to classroom strategies were appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
3. Depth and breadth of attention to instructional materials intended for classroom use were appropriate for the purposes of the session and participants' needs.	1	2	3	4	5	6	7
4. Facilitator(s) displayed an understanding of pedagogical concepts (e.g., in their dialogue with participants).	1	2	3	4	5	6	7
5. Participants were intellectually engaged with important ideas relevant to classroom practice.	1	2	3	4	5	6	7
6. Degree of closure or resolution of conceptual understanding about classroom practice was appropriate for the purposes of the session and the needs of adult learners.	1	2	3	4	5	6	7
7. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Pedagogical content of session not at all reflective of current standards for mathematics/science education				Pedagogical content of session extremely reflective of current standards for mathematics/science education

C. Supporting Evidence for Synthesis Rating

V. Leadership Content

Complete this category only if exploring strategies/issues/roles of teacher leaders was a key purpose of the session. If not, check here ☐ and skip to category VI.

A. Ratings of Key Indicators	Not at all				To a great extent	Don't know	N/A
1. Information on principles of effective staff development was sound and appropriately presented/explored.	1	2	3	4	5	6	7
2. Information on strategies for mentoring/coaching peers was sound and appropriately presented/explored.	1	2	3	4	5	6	7
3. Information on how to be a reform advocate at school/district level was sound and appropriately presented/explored.	1	2	3	4	5	6	7
4. Facilitator(s) displayed an understanding of leadership concepts (e.g., in their dialogue with participants).	1	2	3	4	5	6	7
5. Participants were intellectually engaged with important ideas relevant to the focus of the session.	1	2	3	4	5	6	7
6. Participants were given adequate and appropriate opportunity to consider how the content of the session applies to their particular leadership roles.	1	2	3	4	5	6	7
7. _____	1	2	3	4	5		

B. Synthesis Rating

1	2	3	4	5
Leadership content not at all appropriate for preparing participants to be school/district leaders of mathematics/science education				Leadership content highly appropriate for preparing participants to be school/district leaders of mathematics/science education

C. Supporting Evidence for Synthesis Rating

VI. Culture of the Professional Development Session

A1. Ratings of Key Indicators

	Not at all				To a great extent	Don't know	N/A
1. Active participation of all was encouraged and valued.	1	2	3	4	5	6	7
2. There was a climate of respect for participants' experiences, ideas, and contributions.	1	2	3	4	5	6	7
3. Interactions reflected collaborative working relationships among participants.	1	2	3	4	5	6	7
4. Interactions reflected collaborative working relationships between facilitator(s) and participants.	1	2	3	4	5	6	7
5. Participants were encouraged to generate ideas, questions, conjectures, and propositions.	1	2	3	4	5	6	7
6. Investigation and risk-taking were valued.	1	2	3	4	5	6	7

A2. Respect for Diversity

An atmosphere of respect and appreciation for diversity (gender, race/ethnicity, and/or cultural background) can greatly enhance the culture of a professional development session. In contrast, fostering stereotypes or exhibiting other overt insensitivity are likely to have the opposite effect. If the culture of this session was affected (positively or negatively) by such instances, please check here ☐ and explain:

B. Synthesis Rating

1	2	3	4	5
Culture of the session interferes with engagement of participants as members of a professional learning community				Culture of the session facilitates engagement of participants as members of a professional learning community

C. Supporting Evidence for Synthesis Rating

VII. Overall Ratings of the Session

While the impact of a single professional development session may well be limited in scope, it is important to judge whether the session is helping move participants in the desired direction. For ratings in Sections A and B below, consider all available information (i.e., your previous ratings of design, implementation, content, and culture; related interviews; and your knowledge of the overall professional development program) as you assess the likely impact of this session. Feel free to elaborate on ratings with comments in the space provided.

A. Likely Impact on Participants' Capacity to Provide High Quality Mathematics/Science Education

Consider the likely impact of this session on the participants' capacity to provide high quality mathematics/science education. Select the response that best describes your overall assessment of the *likely effect* of this session in each of the following areas.

☐ Not applicable (The session did not focus on building capacity for classroom instruction.)

	Negative effect		Mixed or Neutral effect		Positive effect	Don't know	N/A
1. Participants' ability to identify and understand important ideas of mathematics/science.	O	O	O	O	O	O	O
2. Participants' understanding of mathematics/science as a dynamic body of knowledge generated and enriched by investigation.	O	O	O	O	O	O	O
3. Participants' understanding of how students learn.	O	O	O	O	O	O	O
4. Participants' ability to plan/provide high quality mathematics/ science classroom instruction.	O	O	O	O	O	O	O
5. Participants' ability to implement the designated instructional materials.	O	O	O	O	O	O	O
6. Participants' self-confidence as mathematics/science instructors.	O	O	O	O	O	O	O
7. Professional networking among participants with regard to mathematics/science instruction.	O	O	O	O	O	O	O

Comments (optional):

B. Likely Impact on Participants' Leadership Capacity

If the session included teacher leaders, consider the likely impact of this session on their leadership capacity. Select the response that best describes your overall assessment of the *likely effect* of this session in each of the following areas. Please note that even if an element was not addressed explicitly, it might have a negative or positive effect on leadership development, depending on whether it was modeled well or poorly.

☐ Not applicable (The session did not include teacher leaders.)

	Negative effect		Mixed or Neutral effect		Positive effect	Don't know	N/A
1. Leaders' knowledge and understanding of mathematics/science.	○	○	○	○	○	○	○
2. Leaders' knowledge and understanding of effective classroom practice.	○	○	○	○	○	○	○
3. Leaders' ability to convey to others a vision of effective mathematics/science classrooms.	○	○	○	○	○	○	○
4. Leaders' understanding of teachers' prior knowledge and areas where teachers have difficulty.	○	○	○	○	○	○	○
5. Leaders' understanding of adult learners.	○	○	○	○	○	○	○
6. Leaders' understanding of the reform process.	○	○	○	○	○	○	○
7. Leaders' understanding of important strategies for reform of mathematics/science education.	○	○	○	○	○	○	○
8. Leaders' ability to plan/implement exemplary professional development.	○	○	○	○	○	○	○
9. Participants' confidence in serving as effective leaders.	○	○	○	○	○	○	○
10. Professional networking among participants with regard to leadership.	○	○	○	○	○	○	○

Comments (optional):

C. Capsule Description of the Quality of the Professional Development Session

In this final rating of the session, consider all available information about the session, its context and purpose, and your own judgment of the relative importance of the ratings you have made. Select the capsule description that best characterizes the session you observed. Keep in mind that this rating is *not* intended to be an average of all the previous ratings, but should encapsulate your overall assessment of the quality and likely impact of the session. Please provide a brief rationale for your final capsule description of the session in the space provided.

- O **Level 1: Ineffective Professional Development**
  There is little or no evidence of participant thinking or engagement with important ideas of mathematics/science education. Session is *unlikely* to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s). Professional development appears to be either (select one below):
  - O **Passive "Learning"**
    Session is pedantic and uninspiring. Participants are passive recipients of information; material is presented in a way that is inaccessible to or inappropriate for many of the participants.
  - O **Activity for Activity's Sake**
    Participants are involved in hands-on activities or other individual or group work, but it appears to be activity for activity's sake. Session lacks a clear sense of purpose and/or a clear link to the conceptual development of participants.

- O **Level 2: Elements of Effective Professional Development**
  Session contains some elements of effective practice in professional development, but there are *substantial problems* in the design, content, and/or implementation given the purposes of the session. For example, the content is presented in a way that would reinforce misconceptions or the pace is clearly too rapid for meaningful participant engagement. Overall, the session is *quite limited* in its likelihood to enhance the capacity of most participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

- O **Level 3: Beginning Stages of Effective Professional Development** (Select one below.)
  O Low 3 O Solid 3 O High 3
  Professional development is purposeful and at times effective, but there are *some weaknesses* in the design, content, or implementation of the session. For example, participants' expertise is not well-utilized; or participants are not given sufficient opportunity to reflect on what they are learning. Overall, the session is *somewhat limited* in its likelihood to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

- O **Level 4: Accomplished, Effective Professional Development**
  Facilitation is skillful and participants are engaged in purposeful work (e.g., investigations, discussions, presentations, reading) designed to enhance their understanding of important mathematics/science concepts, processes, or pedagogy, or to enhance their leadership skills. The facilitator(s) implement the professional development session well and participants' contributions are valued, but adaptation of content or format in response to participants' needs and interests may be limited. The session is *quite likely* to enhance the capacity of most participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

- O **Level 5: Exemplary Professional Development**
  Facilitation is skillful, and participants are highly engaged in purposeful work (e.g., investigations, discussions, presentations, reading) designed to enhance their understanding of important mathematics/science concepts, processes, or pedagogy, or to enhance their leadership skills. The session is artfully implemented, with flexibility and responsiveness to participant needs/interests. The session is *highly likely* to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

Please provide your rationale for the capsule rating:

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